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Including the Proceedings of the
AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME XI DECEMBER 4, 1922 NUMBER 12

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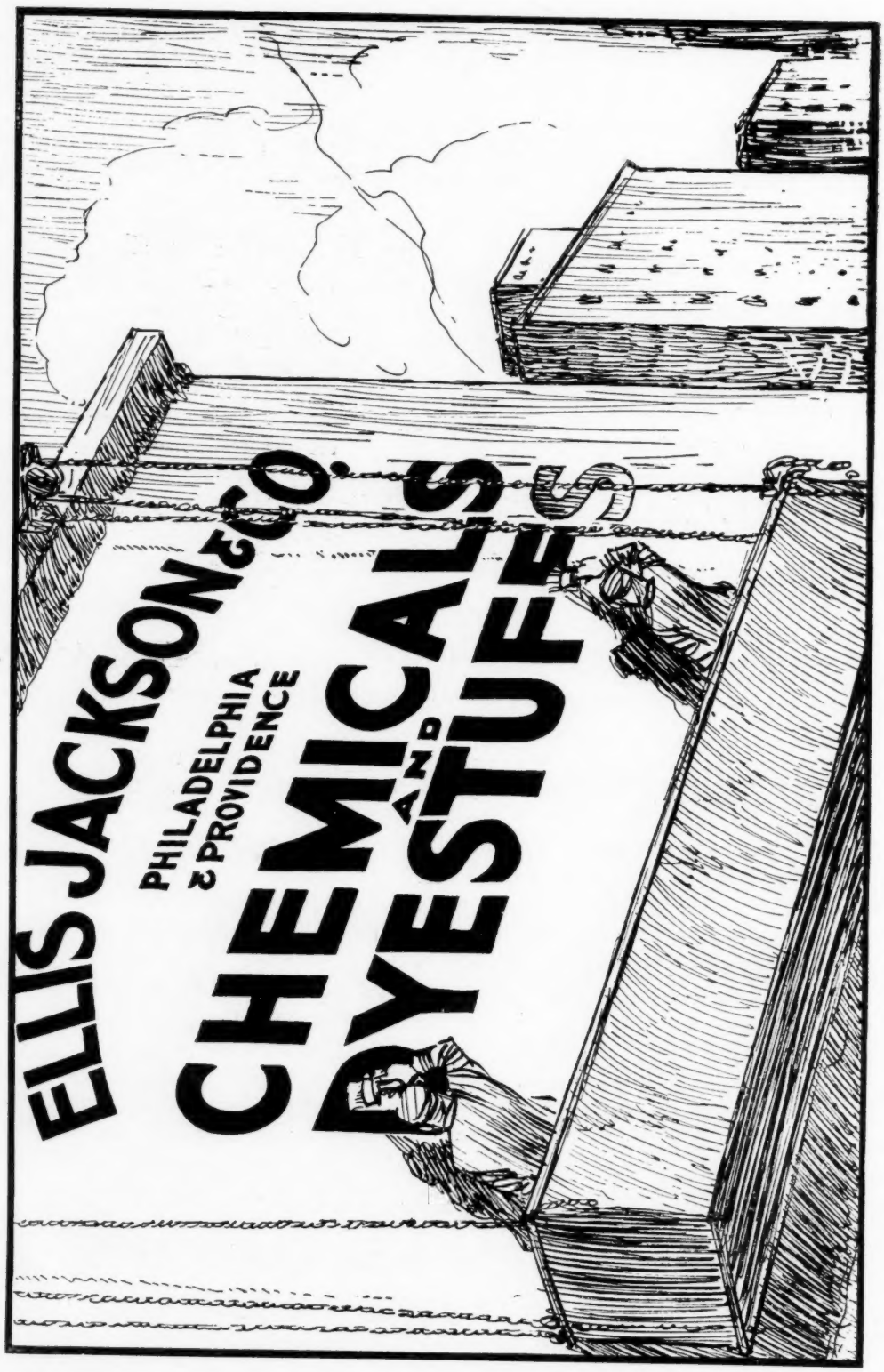
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VOLUME XI NEW YORK, DECEMBER 4, 1922 NUMBER 12

"Oxycellulose": Its Formation and Reactions

A Summary of the Literature

Methods of Oxidation—Potassium Chlorate and Hydrochloric Acid—Chromic and Sulphuric Acids—Hypochlorites—Bromine and Calcium Carbonate—Potassium Permanganate—Persulphates—Hydrogen Peroxide—Ozone—Nitric Acid—Electrolytic Preparation—Ultraviolet Light—Heat—Reactions of, and Tests for, Oxycellulose—Carboxyl and Carbonyl Groups—Dyeing Tests — Vanadium — Color Reactions Furfuraldehyde — Nitric Esters—Acetic Anhydride—Bibliography

By PERCY HERBERT CLIFFORD, B.Sc., A.I.C., and ROBERT GEORGE FARGHER, D.Sc.

The British Cotton Industry Research Association

Transactions of the Textile Institute, Manchester. Printed in the Journal of the Institute

THE discovery that there existed in addition to the ultimate products of the oxidation of cellulose, intermediate substances exhibiting acidic or aldehydic properties, is generally attributed to Witz.[1] Cross and Bevan,[2] who visited his laboratory while the work was in progress, recognized the importance of his observations and proceeded to investigate the reactions involved, with the result that the term "oxycellulose" was suggested for the modified, but still highly complex products, which were further differentiated according to the extent to which oxidation was considered to have taken place. The intervening forty years have seen a succession of communications which have (*a*) dealt with the action of most of the conceivable oxidizing agents, (*b*) described tests for oxidation and consequent deterioration of textile fabrics, (*c*) compared the properties and reactions of the modified products with those of normal cellulose, and (*d*) studied them in relation to the processes of bleaching,[3] mercerizing,[4] dyeing and printing,[5] without, however, defining satisfactorily the complex mixture of substances known as "oxycellulose."

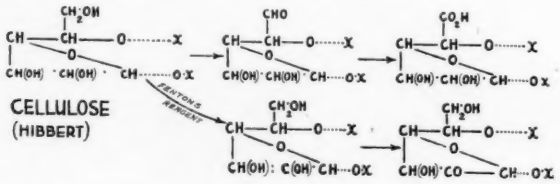
Some of the methods of oxidation may, and probably do, cause hydrolysis as well as oxidation, but, even when this is recognized, it is difficult to distinguish conclusively the products of either reaction. The present report is devoted, therefore, to a consideration of the oxidation of cellulose, whether the conditions admit of concurrent hydrolysis or not.

Compared with the parent substance, the intermediate products of oxidation are relatively unstable and, consequently, tend to undergo further change, the principal products being oxalic acid and carbon dioxide, although acetic acid, tartaric acid, "other unidentified C_4 and C_5 acids," saccharic acid,[7] and "soluble oxidized carbohydrates"[8] have also been recognized.

The portion normally insoluble in neutral agents is differentiated by caustic alkalis into two fractions—an insoluble portion consisting most probably of a mixture of unchanged cellulose and products with reducing properties, and a soluble portion which usually, though not necessarily, displays a reducing action also. The acidity of the products varies considerably, some dissolving in ammonium hydroxide, pyridine, piperidine or sodium carbonate,[9] while others dissolve only in caustic alkalis.

Bancroft and Currie[10] have stated that oxycellulose loses its power of reducing Fehling's solution on heating, and have suggested that the reducing properties are characteristic not of oxycellulose but of other degradation products. They consider that the material insoluble in sodium hydroxide (alpha oxycellulose) is entirely unchanged cellulose, while the soluble portion (beta and gamma oxycellulose) is the one substance in different degrees of aggregation. Evidence has, however, been adduced during the past few years for the presence of a primary alcoholic hydroxyl group in the cellulose molecule,[11] and this has been recognized in the two formulae for cellulose at present most favorably received—those of Hess[12] and Hibbert.[13] The latter considers that the

normal production of oxycellulose depends upon the oxidation of the primary alcoholic groupings in the complex to aldehydic or carboxylic groups, but he has also indicatel a second possible point of attack by Fenton's reagent. The reactions involved are shown in the accompanying formulae, the letter x indicating the points of attachment of the unit cellulose groups.



No attempt has been made to review the subject critically, as it is considered that this can be done more satisfactorily when work at present in progress in these laboratories is completed.

1. METHOD OF OXIDATION

(A) Potassium Chlorate and Hydrochloric Acid

The action of potassium chlorate and hydrochloric acid on cellulose has been studied by Vignon[14] and other workers. Vignon treated purified cellulose with five times its weight of potassium chlorate and of hydrochloric acid ($d = 1.18$) in boiling, dilute aqueous solution, and obtained a white powder which appeared to consist of very fine filaments under the microscope, turned yellow when heated at 100 deg. Cent., reduced Fehling's solution, gave Schiff's reaction, developed a blue coloration with iodine and sulphurous (*sic*) acid more rapidly than cellulose, and dissolved partly in caustic alkalis forming a bright yellow solution. The heat of combustion was less than that of cellulose (4,133 to 4,124 cals. per gram as against 4,244 to 4,190 cals.) and the heat developed in normal sodium hydroxide solution greater (1.3 cals. per 100 grams, as against 0.74 cals. per 100 grams). By treatment with potassium hydroxide (28 per cent) the product was separated into soluble (40 per cent) and insoluble (60 per cent) portions, the latter closely resembling cellulose but still reducing Fehling's solution, while the former was only partly reprecipitated on cautious addition of hydrochloric acid. Analyses of this product agreed closely with those of cellulose, from which it differed, however, by heat of formation, ability to form furfuraldehyde, a slight solubility in water, solubility in alkalis, reducing action on Fehling's solution, and reaction with Schiff's reagent. Addition of alkali or alkaline earth chlorides to the alkaline solution caused precipitation.

(B) Chromic Acid and Sulphuric Acid

Cellulose is attacked very slowly by dilute solution of chromic acid, but oxidation proceeds more readily in the presence of sulphuric acid. The results of oxidations carried out by Cross, Bevan and Beadle[15] at the ordinary temperature are indicated in the following table:

Ratio Available oxygen : $C_6H_{10}O_2$	Concentration of CrO_5	Yield of Insoluble Product ("oxycellulose")
1.5 : 1.....	2.1 per cent	93.0 per cent
3.0 : 1.....	3.3 per cent	87.0 per cent
5.5 : 1.....	4.1 per cent	82.3 per cent

The yields are expressed in terms of the starting material recovered in insoluble form. Vignon[16] realized the instability of these intermediate products and found that they were readily oxidized to soluble substances. Thus, after forty-eight hours in the cold, in the presence, presumably, of an excess of the oxidizing agent, the remaining insoluble material amounted to 85 per cent of the cellulose originally taken, while after 120 hours it had diminished to 50 per cent, the insoluble products differing but slightly in their properties. After treatment in boiling solution for an hour, only 45 per cent was recovered in insoluble form.

Qualitatively, the products resembled those obtained from the chlorate process.

(C) Hypochlorites

The slight reactivity of cellulose towards dilute aqueous solutions of hypochlorites forms the basis of the normal bleaching process, as these dilute solutions effectively oxidize the colored matter in cotton. It is recognized, however,[17] that two reactions are taking place, and that cotton may lose strength owing to the formation of a small proportion of modified cellulose. The tendency towards oxidation increases with the concentration of the hypochlorite solution, and the presence of carbon dioxide or sunlight, and rise of temperature[1] also exert a positive influence. The reaction is historically interesting as it was during its investigation that Witz[1] first recognized cellulose. Nastukoff,[18] however, has examined it more thoroughly, and the following details are taken from his work:

Wght. of Cellulose	Bleaching Powder — Solution — Sp. Gr.	Volume	Time	Temp.	*Oxycellulose
†30 gm.....	1.028	1,000 c.c.	24 hr.	20° C.	45 per cent
‡16 gm.....	1.028	1,000 c.c.	48 hr.	20° C.	.....
‡16 gm.....	1.091	500 c.c.	48 hr.	20° C.	45 per cent

*Soluble in 10 per cent NaOH and precipitated by acid. †Treated twice. ‡Carbon dioxide bubbled through the solution; under these conditions very little cellulose escaped attack.

The crude reaction product was in each case washed well with water, with dilute acetic acid, again with water, and treated with a liter of cold 10 per cent sodium hydroxide. After from two hours to three days, the solution was filtered, the filtrate acidified with hydrochloric acid, and the resulting precipitate washed with water, al-

cohol and ether. The portion insoluble in alkali appeared to be unchanged cellulose, and, in the first of the above experiments, amounted to 30 per cent of the original material.

The product gave the usual reactions with Fehling's solution and phenylhydrazine, but yielded only 1.1 per cent of furfuraldehyde. From the analytical data the conclusion was drawn that one atom of oxygen had been taken up for every 4 to 6 unit cellulose group.

Witz[1] called attention to the affinity of the portion soluble in alkalis for basic dyes and for certain inorganic compounds, notably vanadium salts.

(D) Bromine and Calcium Carbonate

Faber and Tollens[7] found that the oxidation of cellulose with bromine in the presence of calcium carbonate was less vigorous than when using the methods already described. Thus, using equal weights of bromine, chalk and cellulose in 7 per cent aqueous suspension, the bromine was not absorbed completely until seven days had elapsed, even with continued shaking and warming. In later experiments, bromine equivalent to 60 per cent of the weight of cellulose was added in separate portions over the period of oxidation. The insoluble products amounted to 85 to 90 per cent of the cellulose initially present, reduced Fehling's solution, reacted slowly with Schiff's reagent, gave a bluish violet coloration with a solution of iodine in zinc chloride, but did not dissolve in dilute alkalis, although a yellow coloration appeared on boiling. Furfuraldehyde (1.4 to 1.8 per cent) was obtained by distillation with hydrochloric acid. The portion of the soluble products isolated by concentration of the aqueous solution and subsequent precipitation by means of alcohol yielded salts of saccharic acid.

(E) Potassium Permanganate

The conditions under which cellulose is oxidized by potassium permanganate have been investigated in considerable detail. Nastukoff,[19] for example, has proceeded as indicated in the following table, the potassium permanganate being added gradually and the precipitated manganese dioxide removed from time to time by means of sulphurous acid:

Cellulose	Potassium — Permanganate — Amt.	Conc.	Temp.	Time	Yield of *Oxycellulose
16 gm.	11 gm.	1 per cent	20° C.	....	40 per cent
16 gm.	25 gm.	1 per cent	20° C.	14 days	40 per cent
†16 gm.	18 gm.	....	95-100° C.	....	40 per cent

*Soluble in 10 per cent NaOH and repptd. by HCl. †Suspended in 1,600 c.c. of 15 per cent sulphuric acid.

After purification, which was effected as described under "C," all three products seemed to be identical, and, from the analytical data, appeared to have taken up two atoms of oxygen for every 4 to 6 $C_6H_{10}O_5$ units. Treatment with boiling 5 per cent sodium hydroxide effected only partial solution and insoluble residue neither reduced Fehling's solution nor reacted with phenylhydrazine. Knecht and Thompson[20] carried out experiments with finely pulped filter paper, oxidizing it with two or four fifths of its weight of potassium permanganate (one or two atomic proportions of oxygen to each cellulose unit) in 20 to 30 parts of sulphuric acid (7.4 per cent). The insoluble products, freed from adhering acid and salts and decolorized with hydrogen peroxide, were assumed to consist entirely of oxycellulose, the yields amounting to over 90 per cent of the weight of cellulose originally taken. The less highly oxidized product possessed great affinity for basic dyes and gave a dark brown coloration with a solution of iodine in potassium iodide, which was discharged very easily by washing with cold water. It reacted with phenlyhydrozine and rho nitrophenylhydrazine, the nature of the products varying so considerably with the conditions as to suggest adsorption and not definite combination as the cause. Reducing agents had little effect. It dissolved almost completely in sodium hydroxide, and the colorless product precipitated on acidification showed only very slight reducing properties but still had a strong affinity for methylene blue. The portion of the more highly oxidized preparation which was insoluble in caustic alkalis reduced Fehling's solution and reacted the rho nitrophenylhydrazine. Some evidence was also obtained of loose combination with ammonia, sodium hydrogen, sodium hydrogen sulphite, hydrogen cyanide, hydrazine and hydroxylamine. In alkaline solution, cupric, ferric, and silver salts, and certain dyes were strongly reduced. More recently[8,9] the same authors have shown that over a range of 0 to 1 atomic proportions of oxygen to each $C_6H_{10}O_5$ unit, the "copper number" of the product is approximately proportional to the amount of oxidizing agent employed.

By treating cellulose in alkaline solution at 40 to 50 deg. Cent., with permanganate corresponding to seven atomic proportions of oxygen to two $C_6H_{10}O_5$ units, Cross and Bevan[8] obtained about 50 per cent of oxycellulose (insoluble product of the reaction) 16 per cent of "soluble oxidized carbohydrates," 20 per cent of oxalic acid, and also carbon dioxide and traces of volatile acids. Berl and Klaye[21] have used calcium permanganate, and Zeisel and Stritar[22] a mixture of potassium permanganate and nitric acid. Kurz[23] has suggested the use of an oxycellulose paste obtained by oxidation with permanganate in calico printing.

By treatment of an oxycellulose soluble in caustic alkalis with 5 per cent sulphuric acid at 95 to 100 deg. Cent., and then with 10 per cent sodium carbonate at 70 to 100 deg. Cent., Nasturkoff[24] obtained a product (gamma oxycellulose) which dissolved in water, dilute solutions being opalescent by reflected and yellow by transmitted light, while concentrated solutions resembled viscose or glycerol. The solubility appeared to depend

upon the peptizing action of the alkali carbonate. The customary reactions with Fehling's solution and phenylhydrazine were observed, and negative results were obtained with the iodine and pentosan reactions.

(F) Persulphates

By the action of ammonium persulphate and to a lesser extent potassium persulphate, Dietz[25] observed the formation of "oxycellulose," an acidic substance and traces of a peroxide. [Cross and Bevan[26] and Doree[27] have observed the formation of peroxides by other oxidizing agents.] The presence of sulphuric acid favored the formation of the peroxide and the acidic substance, temperature also exercising a considerable effect. Thus, at 25 deg. Cent., small quantities of all three components were formed, at 40 deg. Cent. oxycellulose and the peroxide and preponderated, while at 65 deg. Cent. the chief products were the peroxide and acidic substances. Above 80 deg. Cent., reaction was more vigorous, but the peroxide formed suffered immediate decomposition. The peroxide was much more stable when dry than in the moist condition.

(G) Hydrogen Peroxide

The formation of oxycellulose by means of hydrogen peroxide was first recorded by Witz.[1] Prud'homme[28] found that magnesia, zinc oxide, or cadmium oxide exercised a similar effect in the presence of oxygenated water, and attributed this to the intermediate formation of peroxides. Other writers have described the effect of air in the presence of the alkali hydroxides and carbonates[29] and the alkaline earth hydroxides;[30] while oxidation by hydrogen peroxide in the presence of lead[31] or of a chromium hydroxide mordant[32] has been recorded.

The effect of solutions of hydrogen peroxide on cellulose has been studied more fully by Bumcke and Wolffenstein.[33] Accepting Wurster's explanation[34] of the production of reducing sugars from sucrose by the action of hydrogen peroxide, they suggested that hydrogen peroxide exercises a hydrolytic action, and designated the product "hydralcellulose." The properties described are, however, common to the oxycelluloses of other workers. Filter paper was exposed to the action of varying amounts of hydrogen peroxide of different strengths until completely disintegrated, a result requiring 19 to 90 days at the ordinary temperature. From analytical data they proposed a formula differing from that of cellulose by the addition of the elements of water to 5 to 8 $C_6H_{10}O_5$ units, but the differences are much too small to render the suggestion important. Their product failed to react with iodine, but reduced Fehling's solution and ammoniacal silver nitrate, restored the color of Schiff's reagent, and combined with phenylhydrazine. Treatment with boiling 10 per cent sodium hydroxide resolved it into soluble (one-third) and insoluble (two-thirds) portions, the former being designated "acid cellulose," and the latter being said to resemble cellulose closely.

Products resembling "acid cellulose" were obtained by boiling cellulose repeatedly with 30 per cent sodium hydroxide and by acidification of solutions of cellulose in Schweitzer's reagent. All three products were non-reducing, acid in reaction to phenolphthalein, and very readily hydrolyzed by acids. When dried, however, they no longer dissolved in alkalis and were more resistant to acids, a result attributed to lactone formation.

(H) Ozone

As early as 1868, Kolb[35] exposed linen to the action of ozone and found that the cellulose was attacked and its weight increased. Witz[1] and Vignon[14] also noted the oxidizing action of ozone on cellulose. More recently, the action of oxygen containing 1.4 to 2 per cent of ozone on moist and dry cotton has been studied by Cunningham and Doree[27] who concluded that the principal products are a cellulose peroxide (detected by liberation of iodine from a solution of potassium iodide) and an acid derivative, and that these yield a neutral product resembling the typical oxycelluloses when boiled with water. Absence of moisture was found to favor the production of the peroxide, while, generally, the physical condition of the cotton and its previous treatment influenced the reaction. The crude products were white, sensitive to light, acid in reaction, and to a slight extent soluble in water. Boiling 10 per cent potassium hydroxide dissolved about 65 per cent and apparently caused hydrolysis, as acidification produced little or no precipitation. On distillation with steam, small quantities of an acid, possibly acetic acid and an unrecognized, apparently crystalline, substance volatilized. The aqueous digest was acid in reaction, possessed powerful reducing properties and gave furfuraldehyde amounting to 3.4 per cent of the dissolved material on distillation with hydrochloric acid. Analysis of the insoluble product agreed with that of Vignon's oxycellulose. The action of ozone on beechwood[36] and jute[27] was also studied. In a later communication,[37] Doree showed that the properties of the peroxide were not due to retained ozone and that when it was treated with water hydrogen peroxide was liberated.

(J) Nitric Acid

The use of nitric acid led possibly to the first preparation of oxycellulose, for Mulder,[38] by the prolonged action of fuming nitric acid on various kinds of wood, paper, flax, etc., isolated products which he supposed to be pure cellulose, but which were in reality oxidized derivatives.[39]

By the action of boiling 60 per cent nitric acid, Cross and Beban[6] obtained a gelatinous product entirely soluble in dilute alkalis and reprecipitated by alcohol, acids, neutral salts and strong solutions of alkalis. About 70 per cent of the original cellulose was oxidized to carbon di-

oxide and oxalic acid. When freshly prepared, the insoluble product dissolved in sulphuric acid to a pink solution, and was not colored by iodine or Schulze's solution, but when dry it was colored deep blue by the latter. It yielded a mononitrate with nitric and sulphuric acids. Similar products were obtained by Tollens and his collaborators,[39 40 41] who observed the reduction of Fehling's solution, reaction with Schiff's reagent, and production of furfuraldehyde on boiling with hydrochloric acid. They investigated to some extent the acid hydrolysis of the products. The following figures are taken from the experiments of Bull,[9] Faber and Tollens[7] and Nastukoff[42] (c. f. Piest[43]):

Observer	Conc. HNO_3	Ratio HNO_3 (100%) to Cotton	Temp.	Time	Yield (insol. prod.)
Bull	60.0%	6.0 to 1	95 to 100° C.	24 hr.	35%
Faber & Tollens	47.5%	3.3 to 1	95 to 100° C.	2½ hr.	70%
Nastukoff	47.5%	1.2 to 1	95 to 100° C.	..	90%

Bull's product dissolved completely in aqueous solutions of ammonia, pyridine, piperidine, sodium carbonate, sodium hydroxide, or potassium hydroxide. It gave a bluish-violet coloration with Schultze's reagent, but did not reduce Fehling's solution.

Faber and Tollens found tartaric acid and other unidentified C_4 and C_5 acids among the products of oxidation. The oxycellulose reduced Fehling's solution strongly, dissolved in dilute alkalis and in ammonium hydroxide, and yielded furfuraldehyde on distillation with hydrochloric acid. Further treatment with nitric acid resulted in a product more readily soluble in alkalis but otherwise similar in its properties, which give dihydroxybutyric acid and saccharic acids when boiled with lime water.

The product obtained by Nastukoff dissolved completely in boiling ammonium hydroxide, and yielded a barium salt containing 5 per cent of barium.

Vignon[44] obtained an oxycellulose by reduction of highly nitrated cellulose with ferrous chloride; while Knecht[45] prepared an unstable nitrate from cellulose which yielded an oxycellulose similar to that obtained by direct action of nitric acid, when heated at 100 deg. Cent. in a partial vacuum.

(K) Electrolytic Preparations

Oertel[46] has investigated the electrolysis of cellulose in a neutral 15 per cent solution of potassium chloride, and reports that the material was ultimately converted completely into soluble products. When this dissolution had taken place to the extent of about 70 per cent, the residue dissolved completely in cold 10 per cent sodium hydroxide, and further electrolysis yielded a product which appear to give a stable colloidal solution in water. The "copper value" of the products was high, a maximum of 39.5 being recorded, but the furfuraldehyde value remained normal. The viscosity as determined by Ost's method reached a minimum at an early stage. Compared with cellulose, the products were more readily susceptible to hydrolysis by acids and to acetylation in presence of zinc chloride, but acetolysis by Ost's method yielded 30 per cent of crystalline cellobiose acetate whereas cellulose gave 40 per cent.

(L) Ultra-violet Light

Doree and Dyer[47] have studied the effect of ultra-violet light on cotton fabrics, and have found that the exposed material suffers complete loss of tensile strength, dissolves in dilute solutions of sodium hydroxide, reduces Fehling's solution strongly, absorbs basic dyes, and gives a comparatively large amount of furfuraldehyde.

(M) Action of Heat

Knecht[48] has examined the effect of prolonged heating at moderate temperatures on cotton cellulose and finds that after 336 hours at 93 deg. Cent. the products show distinct reactions with Fehling's solution and rho nitrophenylhydrazine, and, to a lesser extent, with methylene blue and benzopurpurine.

II. REACTIONS OF, AND TESTS FOR, OXYCELLULOSE

The reactions of oxycellulose are, for the most part, conditioned by the presence of carbonyl or carboxyl groupings. Most of them are given by both oxycellulose and hydrocellulose, and it is therefore doubtful whether these can be distinguished satisfactorily.

(A) Reactions Characteristic of the Carboxyl Group

(i) *Solubility in Alkalis.*—Probably the commonest test for modification cellulose is the solubility in boiling dilute sodium hydroxide. Quantitatively, it is customary to boil the sample with 100 parts of 3 per cent sodium hydroxide for an hour and to determine the loss in weight, so that when the loss is small the test is subject to conisderable error. The effect of the concentration of the alkali and the extraction temperature on the amount of material dissolved does not appear to have been determined, though Allan[49] has indicated that a considerable variation exists. Oxycellulose may, or may not, dissolve in ammonia, sodium or potassium carbonate, pyridine, piperidine, etc., according to the mode of preparation.[9]

(ii) *Evidence of the Presence of the Carboxyl Group.*—Schwalbe and Becker[50] have determined the acidity of a number of representative oxy and hydro celluloses, (*a*) by titration with N/100 sodium hydroxide, at the ordinary temperature with litmus, and at 80 deg. Cent. with phenolphthalein, as indicators, the figures being cor-

rected for the alkalinity of the ash, and (*b*) by the amount of barium taken up from a baryta solution. The data, together with the other constants determined, are collected in Table I:

TABLE I.

Results calculated on water and ash free material.

Material examined.	Copper Number.	Yield of furfuraldehyde.	"α-Cellulose."	Material resistant to baryta.	Barium taken up.	Acidity cc N/100 NaOH per gram.		Alkalinity of ash cc. N/100 HCl per gram.	Total acidity.	Microscopic appearance with 20% I—KI.	Colour with methyl Orange + NaCl.
						litmus.	phenol-phthalein 80°C				
Cellulose (cotton)	0·28	0·69%	98·85%	97·8%	0·02%	1·5	....	0·3	1·8	yellow	yellow
Oxycellulose from cotton (hypochlorite)	11·0	0·26	62·0	59·7	2·18	39·4	40·7	2·0	41·4	yellow	very bright red
Oxycellulose from wood cellulose (hypochlorite)	33·2	3·32	58·6	61·5	....	12·7	13·8	20·7	33·4	violet	red
Oxycellulose from cotton ($KMnO_4$)	8·03	1·28	61·8	65·6	1·46	27·3	27·0	0·4	27·7	yellow	very bright red
Oxycellulose from cotton (H_2O_2)	5·8	0·94	78·3	77·2	0·34	10·1	11·6	0·3	10·4	yellow-brown	bright red
Hydrocellulose from cotton (Girard)	3·64	1·24	83·7	75·3	0·10	3·7	4·0	0·9	4·6	yellow-violet	yellow-brown
	6·22	....	....	63·0	....	....	....	....	....	yellow-violet	yellow-brown
Hydrocellulose from cotton (Lederer)	5·67	0·76	88·45	76·3	0·17	....	....	....	....	pale violet	yellow

They suggest that the arbitrary calculation of the "copper number" on 100 grams of material soluble in baryta instead of on 100 grams of the material used, distinguishes oxycellulose from hydrocellulose. Figures illustrating this, and calculated from the numbers in Table I are as follows:

	Copper No.
Oxycellulose from cotton (hypochlorite)	27.3
Oxycellulose from cotton (permanganate)	23.4
Oxycellulose from cotton (hydrogen peroxide)	25.4
Hydrocellulose (Girard)	14.8
Hydrocellulose (Girard)	16.8
Hydrocellulose (Lederer)	23.6

The last figure (for hydrocellulose prepared by Lederer's method) is not included in their table, and would seem, in view of the small number of determinations, to invalidate the conclusion.

Heuser and Stockigt[55] state that the evolution of carbon dioxide during acid hydrolysis is characteristic of oxycellulose, and is not exhibited by hexoses, cellulose or hydrocellulose. They have employed the reaction to measure quantitatively the carboxyl content of oxycellulose. Typical figures are as follows:

Substance	Per Cent CO_2H
Oxycellulose (H_2O_2)	0.29
Oxycellulose ($KMnO_4$)	0.65; 1.04
Oxycellulose (CrO_3)	1.32
Oxycellulose ($KClO_3$)	0.66
Oxycellulose (HNO_3)	0.97; 0.83
Cotton cellulose	0.03
Hydrocellulose (Girard)	0.04

(B) Reactions Characteristic of the Carbonyl Group

(i) *Phenylhydrazine, Etc.*—A number of observers have examined the interaction of phenylhydrazine and oxidized cellulose and have assumed that definite chemical combination takes place. Recently, however, Knecht and Thompson[29] have suggested that the amount of the hydrazine which enters into combination varies so considerably with the experimental conditions that adsorption and not chemical combination is the underlying cause. The same writers have observed loose combination between oxycellulose prepared by the action of potassium permanganate and rho nitrophenylhydrazine, hydroxylamine, semicarbazide, hydrazine hydrate, sodium bisulphite, ammonia, and hydrogen cyanide. Figures indicating the extent of reaction with phenylhydrazine are incorporated in the following table:

Observer	Oxidant	Percentage of Phenylhydrazine Fixed
Vignon[52]	$KClO_3 + HCl$	7.94
Vignon[52]	$CrO_3 + H_2SO_4$	7.0
Vignon[52]	$CrO_3 + H_2SO_4$	7.7
Vignon[52]	$CrO_3 + H_2SO_4$	8.5
Nastukoff[18]	$KMnO_4 + H_2SO_4$	2.7
Bumcke & Wolffenstein[33]	H_2O_2	6.5 to 7

(ii) *Reduction Tests.*—Reduction of Fehling's solution has long been recognized as a qualitative test for modified celluloses, and Lloyd[53] has described exact conditions for its use. Berl and Klaye[21] have compared the relative reduction values of a number of oxycelluloses and suggested that these values were lowest in the case of products obtained by the action of bromine or potassium chlorate, and highest when potassium permanganate was the oxidizing agent, while Bumcke and Wolffenstein[33] have compared the reducing power of "hydralcellulose" with glucose under identical conditions. Schwalbe[54] realized that the decomposition of oxycellulose, hydrocellulose, and cellulose itself, by boiling alkalis, did not reach a final point and therefore proposed the adoption

(*Continued on page* 427.)

American-Made Colors

A Classified List of All Dyes of American Manufac ture, Giving the Name of the Maker and His Trade Name for Each Product

Eosines and Similar Products. Fur Dyes. Nigrosines, Induline and Oil Colors. Sulphur Colors. Vat Colors

EOSINES

And Similar Products

Boiling Bromo
New York Color & Chemical Co.

Bromo Fluoresic Acid A3G
New York Color & Chemical Co.

Bronze Bromo
New York Color & Chemical Co.

Eosine J
New York Color & Chemical Co.

Eosine B
New York Color & Chemical Co.

Du Pont Eosine BA
E. I. du Pont de Nemours & Co.

Eosine Ag. Ex.
New York Color & Chemical Co.

Erythrosine
New York Color & Chemical Co.

Du Pont Erythrosine B
E. I. du Pont de Nemours & Co.

Phloxine
New York Color & Chemical Co.

Du Pont Phloxine B
E. I. du Pont de Nemours & Co.

Du Pont Rose Bengal
E. I. du Pont de Nemours & Co.

Rose Bengal
New York Color & Chemical Co.

FUR DYES

BLACK

Fur Black
Tower Mfg. Co., Inc.

Para-phenylene-diamine
The Sherwin-Williams Co.

Furamine D
Seydel Chemical Co.

Furamine B
Seydel Chemical Co.

Furamine DB
Seydel Chemical Co.

BROWN

Dyelene Ursol X
Dye Products & Chemical Co., Inc.

Fur Brown
Tower Mfg. Co., Inc.

Furamine P
Seydel Chemical Co.

YELLOW

Furamine 2G
Seydel Chemical Co.

NIGROSINES

Induline and Oil Colors

BLACK

National Nigrosine
National Aniline & Chemical Co.

Du Pont Nigrosine SSB
E. I. du Pont de Nemours & Co.

Du Pont Nigrosine SSJ
E. I. du Pont de Nemours & Co.

Du Pont Nigrosine WSB Crystals
E. I. du Pont de Nemours & Co.

Du Pont Nigrosine WSB Powder
E. I. du Pont de Nemours & Co.

Du Pont Nigrosine WSJ Crystals
E. I. du Pont de Nemours & Co.

Du Pont WSJ Powder
E. I. du Pont de Nemours & Co.

Nigrosine
Central Dyestuff & Chemical Co.

Calco Nigrosine SSJ
Calco Chemical Co.

Calco Nigrosine SSB
Calco Chemical Co.

Calco Nigrosine WSJ
Calco Chemical Co.

Calco Nigrosine WSB
Calco Chemical Co.

Nigrosine (water soluble)
Grasselli Chemical Co.

Nigrosine (spirit soluble)
Grasselli Chemical Co.

National Oil Black (seven types)
National Aniline & Chemical Co.

National Oil Black Powder
National Aniline & Chemical Co.

National Liquid Oil Black
National Aniline & Chemical Co.

National Lump Oil Black
National Aniline & Chemical Co.

BLUE

Induline (spirit soluble)
Central Dyestuff & Chemical Co.

Induline (spirit soluble)
Grasselli Chemical Co.

BROWN

National Oil Brown M
National Aniline & Chemical Co.

Oil Brown R
American Aniline Products, Inc.

Oil Brown 100
American Aniline Products, Inc.

ORANGE

National Oil Orange 2311
National Aniline & Chemical Co.

Oil Orange Conc.
American Aniline Products, Inc.

Newport Oil Orange Extra Conc.
Newport Chemical Works, Inc.

RED

National Oil Maroon O
National Aniline & Chemical Co.

National Oil Red O
National Aniline & Chemical Co.

National Oil Scarlet 6G
National Aniline & Chemical Co.

Red B
Central Dyestuff & Chemical Co.

Sudan I
Central Dyestuff & Chemical Co.

Sudan IV
Central Dyestuff & Chemical Co.

Sudan X
Central Dyestuff & Chemical Co.

Sudan AN
Central Dyestuff & Chemical Co.

Sudan AX
Central Dyestuff & Chemical Co.

Newport Oil Red 3BX
Newport Chemical Works, Inc.

Oil Scarlet B
Cincinnati Chemical Works

Oil Red 3B
American Aniline Products, Inc.

Oil Scarlet
American Aniline Products, Inc.

YELLOW

Oil Yellow I
American Aniline Products, Inc.

Oil Yellow II
American Aniline Products, Inc.

Yellow B
Central Dyestuff & Chemical Co.

Yellow D
Central Dyestuff & Chemical Co.

Yellow T
Central Dyestuff & Chemical Co.

National Oil Yellow 2681
National Aniline & Chemical Co.

Newport Oil Yellow
Newport Chemical Works, Inc.

SULPHUR COLORS

BLACK

Sulphur Black
E. C. Klipstein & Sons Co.

National Sulphur Black R
National Aniline & Chemical Co.

National Sulphur Black F Paste
National Aniline & Chemical Co.

National Sulphur Black BG Ex. Conc.
National Aniline & Chemical Co.

Sulfogene Black AX
E. I. du Pont de Nemours & Co.

Sulfogene Carbon 8G Conc.
E. I. du Pont de Nemours & Co.

Sulfogene Carbon H Conc.
E. I. du Pont de Nemours & Co.

Sulfogene Carbon M Conc.
E. I. du Pont de Nemours & Co.

Sulphur Black
Grasselli Chemical Co.

Atlantic Black B Extra
Atlantic Dyestuff Co.

Atlantic Black R Extra
Atlantic Dyestuff Co.

Atlantic Black G Extra
Atlantic Dyestuff Co.

Atlantic Black BG Extra
Atlantic Dyestuff Co.

Atlantic Patent Black B Ex.
Atlantic Dyestuff Co.

Atlantic Patent Black 2B Ex.
Atlantic Dyestuff Co.

Atlantic Patent Black B Ex. Strong
Atlantic Dyestuff Co.

Atlantic Patent Black R Ex. Strong.
Atlantic Dyestuff Co.

Atlantic Patent Black 2R Ex. Strong
Atlantic Dyestuff Co.

BLUE

Sulphur Blue BC Ex. Conc.
Beaver Chemical Co., Inc.

Sulphur Blue BCR Conc.
Beaver Chemical Co., Inc.

Sulphur Blue BCG Conc.
Beaver Chemical Co., Inc.

Sulphur Blue
Holland Aniline Co.

Sulfogene Indigo Blue G Conc.
E. I. du Pont de Nemours & Co.

Sulfogene Navy Blue RL Conc.
E. I. du Pont de Nemours & Co.

National Sulfindone Blue B Conc.
National Aniline & Chemical Co.

Sulphur Blues (four types)
Tower Mfg. Co., Inc.

Atlantic Blue (three types)
Atlantic Dyestuff Co.

Atlantic Sky Blue GS
Atlantic Dyestuff Co.

BROWN

National Sulphur Brown CG
National Aniline & Chemical Co.

National Sulphur Brown 2G
National Aniline & Chemical Co.

National Sulphur Brown 4G
National Aniline & Chemical Co.

National Sulphur Brown 3R
National Aniline & Chemical Co.

Sulphur Browns
Trico Chemical Co., Inc.

Sulphur Drabs
Trico Chemical Co., Inc.

Sulphur Browns
Cooks Falls Dye Works, Inc.

Sulphur Tans
Cooks Falls Dye Works, Inc.

Sulphur Cutch.
Cooks Falls Dye Works, Inc.

Sulphur Brown R
American Aniline Products, Inc.

Sulphur Yellow Brown 2G
American Aniline Products, Inc.

Sulphur Khaki
Grasselli Chemical Co.

Sulphur Tan
Grasselli Chemical Co.

Sulphur Brown
Grasselli Chemical Co.

Sulphur Yellow Brown
Grasselli Chemical Co.

Sulphur Red Brown
Grasselli Chemical Co.

Catechu de Lavelle
E. C. Klipstein & Sons Co.

Sulfogene Brown GO
E. I. du Pont de Nemours & Co.

Sulfogene Dark Brown GN Extra
E. I. du Pont de Nemours & Co.

Sulphur Dark Brown
Holland Aniline Co.

GREEN

Amalthion Green 2G
John Campbell & Co.

Sulphur Olive Green
Cooks Falls Dye Works, Inc.

Sulphur Green
Holland Aniline Co.

Sulphur Olive
Grasselli Chemical Co.

Sulfogene Green M Conc.
E. I. du Pont de Nemours & Co.

Sulphur Greens
Trico Chemical Co., Inc.

National Sulphur Green T
National Aniline & Chemical Co.

ORANGE

Sulphur Orange
Grasselli Chemical Co.

RED

Sulfogene Bordeaux B
E. I. du Pont de Nemours & Co.

Atlantic Maroon
Atlantic Dyestuff Co.

YELLOW

National Sulphur Yellow B
National Aniline & Chemical Co.

National Sulphur Yellow BW
National Aniline & Chemical Co.

Sulfogene Yellow D
E. I. du Pont de Nemours & Co.

Sulfogene Yellow GG
E. I. du Pont de Nemours & Co.

Atlantic Yellow G
Atlantic Dyestuff Co.

Atlantic Yellow R
Atlantic Dyestuff Co.

Sulphur Yellow
Cooks Falls Dye Works, Inc.

VAT COLORS

BLACK

Newport Anthrene Black B
Newport Chemical Works

Ponsol Black B Paste
E. I. du Pont de Nemours & Co.

Ponsol Black B Double Paste
E. I. du Pont de Nemours & Co.

BLUE

National Indigo NAC Powder
National Aniline & Chemical Co.

National Indigo NAC 20% Paste
National Aniline & Chemical Co.

Du Pont Indigo 20% Paste
E. I. du Pont de Nemours & Co.

Ponsol Blue GD Paste
E. I. du Pont de Nemours & Co.

Ponsol Blue GD Double Paste
E. I. du Pont de Nemours & Co.

Ponsol Blue RP Paste
E. I. du Pont de Nemours & Co.

Ponsol Dark Blue BR Paste
E. I. du Pont de Nemours & Co.

Indigo Synthetic 20% Paste
Dow Chemical Co.

Indigo Synthetic Powder
Dow Chemical Co.

Ciba Blue 2B 16% Paste
Dow Chemical Co.

Ciba Blue 2B Powder
Dow Chemical Co.

Midland Vat Blue R 20% Paste
Dow Chemical Co.

Midland Vat Blue R Powder
Dow Chemical Co.

Midland Vat Blue 5B 50% Paste
Dow Chemical Co.

Midland Vat Blue MB 16% Paste
Dow Chemical Co.

Midland Vat Blue MB 30% Paste
Dow Chemical Co.

Midland Vat Blue MB Powder
Dow Chemical Co.

Midland Vat Cadet Blue 50% Paste
Dow Chemical Co.

Newport Anthrene Blue GC
Newport Chemical Works, Inc.

Newport Anthrene Blue GCD
Newport Chemical Works, Inc.

Newport Anthrene Blue RS
Newport Chemical Works, Inc.

Newport Anthrene Dark Blue B O
Newport Chemical Works, Inc.

Newport Anthrene Blue BCS
Newport Chemical Works, Inc.

Newport Anthrene Blue BSP
Newport Chemical Works, Inc.

BROWN

Newport Anthrene Brown BB
Newport Chemical Works, Inc.

GREEN

Newport Anthrene Green B
Newport Chemical Works, Inc.

Newport Anthrene Green G
Newport Chemical Works, Inc.

Newport Anthrene Jade Green
Newport Chemical Works, Inc.

Ponsol Green B
E. I. du Pont de Nemours & Co.

VIOLET

Ponsol Violet RRD Paste
E. I. du Pont de Nemours & Co.

YELLOW

Newport Anthrene Yellow G
Newport Chemical Works, Inc.

Newport Anthrene Yellow R
Newport Chemical Works, Inc.

Ponsol Yellow G Paste
E. I. du Pont de Nemours & Co.

RESTORING THE COLOR OF COTTON OR MIXTURE RAINCOATS

By F. E. Robertson

It is difficult to clean raincoats satisfactorily, as dirt gets fixed firmly on the article owing to the wax or other preparations used in the manufacture of the new material to make it waterproof.

If not satisfactory after dry cleaning, the following process of combined wet cleaning and redyeing will be found to give very good results:

Give a warm soap and soda bath for five to ten minutes in a rotary washer. Take out, examine and brush soiled parts if necessary.

Add 1 ounce Direct Brown, ½ ounce Direct Cotton Green (light shade), ½ to ¾ ounce Direct Cotton Yellow, to a cleaning liquor of 50 gallons of water in the washer, heat to hand heat, re-enter goods and rinse for fifteen minutes. Rinse off, give alum bath and extract.

Note: The dyes should be thoroughly dissolved in a pail of boiling water before putting in the machine. —National Association of Dyers and Cleaners Technical Review.

R. WILHELM TO PURCHASE FOR FUJISAWA

Rutlidge Wilhelm, widely known as American representative of T. Fujisawa & Co., of Osaka, Japan, has established his own offices at 15 Park Row, New York City, where he will specialize in handling Japanese and Chinese chemicals and drugs and act as American purchasing agent for Fujisawa.

Mr. Wilhelm's extensive operations in the American camphor market for this firm, places them at the head of Japanese camphor importers in the United States. Close relations with the Japanese manufacturer and an intimate knowledge of Eastern business policy, are factors that have contributed in a great measure to Mr. Wilhelm's success in trading with the Far Eastern exporter and the American consumer.

MORDANTS

In Three Parts—Part III (Concluded)

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Note—References will be found at the conclusion of this installment, p. 419

"The differences in the opinions expressed regarding the value of chrome alum as a wool mordant are due no doubt to two causes:—first, the different percentages, reckoned on the weight of wool, employed; second, the concentration of the mordanting bath and the quality of the water. Here too, as in the case of the bichromate of potash mordant, little or no attention has been paid to the ratio which ought to subsist between the amounts of colouring matter and mordant employed."

Unless otherwise specified the experiments of Liechti and Hummel were made with ten grams of wool in 600 cc Leeds water. Usually ten percent of chrome alum (referred to wool) was taken which is about equivalent to three percent bichromate of potash. When this solution was heated and cooled without any wool, there was no turbidity. In the presence of wool the bath began to become turbid at about 80°–82°, the turbidity increasing rapidly so that the solution became quite opaque. "The precipitate was excessively fine and had by no means the ordinary flocculent character of chromic hydrate. Now it has long been known that wool has the property of absorbing or attracting in a mechanical manner very finely divided insoluble matter in suspension, and this feature was shown strikingly in the present instance. Before the appearance of the turbidity the wool scarcely showed even traces of any green tint; but from this point it rapidly acquired a yellowish-green colour. At a temperature of about 95° the solution became clear again and, after boiling a little, it was perfectly limpid and almost colourless, the wool having mechanically fixed nearly the whole of the precipitate. When the bath was allowed to cool, it contained only a small quantity of a pale green precipitate, and if the wool was kneaded and pressed in the liquor with the fingers a little of the adhering precipitate could be removed from it; still even with vigorous washing the major portion still remained attached to the wool, colouring it a pleasing shade of yellowish-green." The water contained 14.3 percent of the original chromic oxide content, so that about 86 percent was partly fixed on the wool and partly in the precipitate. "On repeating the experiment with the addition of ten percent sodium chloride to the bath, the decomposition was quite complete, for the waste liquor proved to be entirely free from chromium. Another experiment in which only five percent chrome alum was employed, also showed mere traces of chromium in the filtered liquor. A certain relationship seems therefore to exist between the amounts of wool and of chrome alum, so that, as already stated, when using five percent of the latter total decomposition is produced, while with ten percent it is affected only to the extent of 85.7 percent."

Analyses of the precipitate gave ratios of 0.836, 0.819, 0.538, and 0.360 SO_3 to one of Cr_2O_3. Liechti and Hummel consider that "the varying composition here shown is not surprising, and it is no doubt caused by the different lengths of time taken to heat the bath up to the point of initial turbidity. Moreover, the last portions of chrome alum may also become insoluble by long-continued heating at the boiling point. "Liechti and Hummel average these data and consider that the precipitate is a definite compound having the formula $2Cr_2(SO_4)_3(OH)_4 \cdot Cr_2O_6H_6$ or $Cr_2O_3.0.66SO_3$. Analyses of the solution showed less sulphate percent than there should be. Liechti and Hummel therefore conclude that the wool contains both a basic sulphate and free sulphuric acid. They say that it seems difficult to imagine the presence of basic chromic sulphate and of free sulphuric acid in the wool at the same time; but the corrections of this view will be established by experiments to be cited later on. It may, however, be already stated here that long boiling of the wool with excess of hydrochloric acid did not dissolve off the basic sulphate." In different runs the wool contained 1.9, 2.3 and 1.7 SO_3 to one Cr_2O_3.

Experiments with potassium sulphate alone showed no adsorption by wool, and chromic sulphate apparently gave the same results as chrome alum. When sodium carbonate was added to a chrome alum solution, the solution decomposed badly and the wool was not well mordanted, although it took on a fine sea-green color. Presumably the particles of the chromium compound were too coarse to adhere well to the wool.

"In all cases of mordanting wool with acid salts, as was already observed long ago by Havrez, and referred to more recently by Knecht, the presence of ammonia could be detected in the waste liquors, and this too was observed with certainty, even in the case of the wool mordanted in the cold. The ammonia, however, was not estimated quantitatively. It is well to point out here that in all the analyses of waste liquors given, a portion of the sulphuric acid reckoned as in combination with chro-

mium is really combined with ammonia. It is not unnatural, therefore, to consider that the ammonia which is given off from the wool combines with some of the SO_4 groups of the chrome alum and so effects its decomposition. This occurs undoubtedly; but only to a limited extent, and cannot be accepted as a full explanation of the reaction which takes place, otherwise the analyses would not show any disappearance of sulphuric acid from the waste liquor. To avoid any misconception on this point, consider the following typical case a little more in detail. When wool is boiled with five percent chrome alum in solution, the decomposition of the salt is practically complete, as we have seen. A small amount (equal to $^2/_3$ mol H_2SO_4) is combined with the precipitated Cr_2O_3, so that the waste liquor should contain $^{10}/_3$ mols H_2SO_4 capable of being estimated as barium sulphate. Such is, however, never the case, as numerous analyses have shown; invariably a large proportion of the sulphuric acid is wanting, and must, therefore, have been taken up by the wool."

In order to check up on the results obtained, "an experiment was made in which chrome alum was titrated with normal sodium hydroxide, and it was observed that a first change of color really occurred when one-sixth of the SO_3 was neutralized, and a second change to a decided yellowish-green colour was noticed when one-third of the SO_3 was saturated. These observations correspond exactly with the appearance noticed during the mordanting process, so that the decomposition of the wool can scarcely be explained in any other manner than by considering that the wool gradually absorbs the sulphuric acid from the dissociated green solution with the formation of a more and more basic salt, and that this process continues until the wool becomes saturated under the existing conditions. As above shown, this point occurs when about 85.7 percent of the 10 percent chrome alum presented to the fibre is decomposed, and it has already been shown that five percent chrome alum is decomposed completely by the wool."

In order to determine the effect of increasing concentration "wool was mordanted with 10, 15, 20, 25, 30, 35, and 40 percent chrome alum in the ordinary manner. With increase of concentration of the baths their decomposition was diminished, as indeed was to be expected on physical grounds, so that the solutions containing the largest amounts remained perfectly clear. With the increase in the amounts of mordant used, the separation and fixing of insoluble basic sulphate disappeared gradually; the samples had the appearance of being better mordanted, showing signs of having fixed large amounts of chromium. Instead of the yellowish-green colour observed before they had now a violet-greenish grey tint, and they gave one the impression that chrome alum as such was in a state of solution within the wool fibre. The samples were dyed with logwood, alizarin, and Persian berries, and the colours obtained became darker and darker, corresponding to the increasing amounts of chrome alum employed. When examined more carefully, however, the colours were seen to have an irregular, speckled, or seedy appearance, since separate wool fibres had evidently taken up different amounts of mordant, and therefore of colouring matter as well. A microscopic examination showed this perculiarity extremely well, and fibres of every degree of intensity of colour were to be seen, some being colourless, others very dark; indeed, similar differences were noticed even in one and the same fibre. . . . . Why different fibres should behave so differently, as is here shown, is a moot point; whether it is due to a mixture of wool or whether the mature fibres behave differently to those of more recent growth, with respect to their power of absorption of the mordant constituents, is not yet determined. It always appeared, however, as if the coarser fibres had deeper colours than the thinner ones. In any case it is very striking that similar marked differences are never met with in wool mordanted with bichromate of potash, and explains to some extent the preference of practical dyers for this mordant."

"With chromic acid, i. e., bichromate of potash, it is easy to mordant the wool evenly, so that, when examined microscopically, the individual fibres scarcely differ from each other in depth of colour. With the chromic oxide mordants, however, such regularity is difficult to attain and is only met with in the very best of this class. No doubt this difficulty has to some extent caused practical wool dyers to discard chrome alum. With the dyestuffs above alluded to (logwood, alizarin and Persian berries) and with the increasing amounts of chrome alum, the colors varied respectively from pale grey to deep bluish-black, from pale yellowish-claret to a dark dull-purple, and from straw-yellow to a brownish-orange."

In order to determine the effect of free acid, "wool was mordanted with ten percent chrome alum plus 0, 1, 2, 3, 4 mols sulphuric acid. In baths Nos. 1 and 2 strong dissociation occurred, in No. 3 there was much less, but in Nos. 4 and 5 the solutions remained perfectly clear; the waste liquor of No. 1 appeared almost colourless, but the rest showed a green colouration, which became gradually more intense towards No. 5. Nevertheless the dyed patterns showed that from Nos. 2–5 the amount of chromium increased gradually, Nos. 4 and 5 giving especially dark colours. Here too, however, a microscopic examination showed very unequal dyeing of the different fibres, and the patterns themselves had a 'seedy' appearance, just as when large percentages of chrome alum were employed. In individual fibres the tips always appeared darker than the roots, i. e., the younger parts of the fibre. The same observations were made in the case of unspun lamb's wool scoured in the laboratory, which was tried perchance the woolen cashmere employed contained more than one quality of wool. Here, too, the use of bichromate of potash gave level colours, the irregularities appearing only with the employment of the chromic oxide salt."

"Parallel experiments boiling wool with one gram chrome alum and 6 cc normal H_2SO_4 respectively, i. e.,

equal amounts of SO_3" showed that practically equal amounts of sulphate are adsorbed in the two cases, thus showing "that the decomposition of the chrome alum by the wool is really due to the adsorption of the acid by the fibre."

Liechti and Hummel do not explain how, with the constant amount of chrome alum, both the solution and the wool can become richer in chromium with increasing addition of sulphuric acid; but it is probable that it is at the expense of the precipitate which was not fixed on the wool. This makes these results practically worthless.

They "are inclined to share Knecht's view as expressed in his conclusions, viz., that the acid is not combined permanently with the wool, although it is certainly very difficult to remove the last traces of acid from the fibre. A sample of wool boiled with a solution (600 cc) containing 10 cc normal H_2SO_4 absorbed 0.314 g. When the squeezed wool was extracted as completely as possible with water, and this was neutralised with normal NaOH, the wool still lying in the liquid, the latter invariably became acid again after some time; but by neutralising again and again after similar rests, it was possible to show the presence in the liquid of the full amount of acid originally employed. In another repetition experiment, the wool, having absorbed 0.317 g H_2SO_4, was boiled with water for two hours; the liquid was then neutralised with normal NaOH, and the operations were repeated till no further quantity of sulphuric acid could be extracted: here all the sulphuric acid absorbed could be accounted for. Indeed, in both cases a little more than 10 cc normal NaOH was required, it is namely very difficult to titrate with exactitude in protracted and intermittent operations such as those above, and during the intervening time the indicators may have altered slightly."

It will now be profitable to consider what all this really means. It is apparently clear that with bichromate of potash we have chromic acid adsorbed at first but not strongly and that this is then reduced to a hydrous chromic oxide which is the true mordant. Addition of sulphuric acid cuts down the adsorption of chromic acid because of the adsorption of the sulphuric acid and increases it because of the increasing acidity. What actually happens is the resultant of these two factors. With hydrochloric and nitric acids, the effect due to increasing acidity is the important one. With chromic sulphate or chrome alum, the conditions are quite different because of the high sulphate concentration. It seems quite reasonable that the wool should adsorb sulphuric acid first, setting free a basic sulphate, apparently $Cr_2O_3.0.66\ SO_3$, which is adsorbed by the wool but which is not the actual mordant. The fact that some of this salt appears in the bath shows that the heating schedule is wrong. It is probable that faulty rate of heating is responsible for the uneven dyeing, because alum is used for mordanting wool and the sulphate problem is the same in the two cases. The salt that is precipitated first with alum is said to be $Al_2O_3.0.5\ SO_3$, and of course it is possible that part of the difference in behavior is due to the difference in the properties of the basic aluminum and chromium salts. Speaking as one who has no practical knowledge of dyeing whatsoever, it seems to me that rinsing with a dilute soda solution would be desirable, so as to convert the basic sulphate into the oxide. We know that the statement is not generally true that alizarin will only dye alumina in presence of lime salts. It is true only when the alumina contains sulphate. If a mistake like that can persist for years, it is quite probable that there are still a good many things about mordanting with chrome alum which have been overlooked. Of course the increased mordanting with increasing concentration of chrome alum is just what one would expect. On the other hand I do not see at all why increasing the acid content of a chrome alum bath should increase the amount of chromium taken up. It cannot be true if the heating is conducted so that there is no precipitate formed in the bath because Liechti and Hummel admit that the bath is exhausted less completely when more sulphuric acid is added, which is just as it should be. This is a striking instance of faulty experimentation and this should have been pointed out years ago.

Liechti and Hummel[34] find that chromium chloride and chromium nitrate solutions behave quite differently from chromium sulphate solutions. "It seemed desirable to determine carefully the behaviour of chromium chloride and nitrate towards wool. These salts were prepared from chrome alum in the same manner as the chromium sulphate [by precipitating with caustic soda and dissolving in acid], in order to be quite certain that exactly the same amount of Cr_2O_3 was used in each case. The chromium chloride bath became yellowish-green on heating, but remained perfectly clear throughout. The wool acquired a peculiar greenish-yellow tint and had not the appearance of being mordanted at all. Analysis showed that 86.5 percent of the chromium remained in the waste liquor, so that only 13.5 percent was fixed on the wool. The waste liquor contained $Cr_2(OH)_2Cl_4$, hence the wool must have contained the compound $(Cr_2 + 18.3\ Cl)$. This corresponds to $(Cr_2O_3 + 9.15\ SO_3)$, hence in this case a very acid salt is fixed on the wool. The circumstance that here none of the chromium was precipitated, as was the case with chrome alum, is quite in accordance with the fact that both chromium chloride and nitrate in solution bear the addition of a large proportion of sodium carbonate (up to 2 mols) without a precipitate being formed. With chromium nitrate too, a very indifferent mordanting of the wool was effected, the material acquiring even a paler greenish-yellow tint. The waste liquor contained 0.1339 g Cr_2O_3, i. e., 87.5 percent of the original amount, so that the wool contained only 12.5 percent."

We can, of course, account for the relatively slight mordanting from chloride and nitrate solutions in the same way that Litchti and Hummel have done by referring to the marked peptizing power of these solutions for chromic oxide and that seems the most plausible explanation. In that case, however, addition of a moderate

amount of soda should have increased the mordanting. Doubtless that would have happened; but Liechti and Hummel did not try it, which they should have done in view of the fact that they report that adding sulphuric acid increases the mordanting with chrome alum. It is rather curious that they did not try this, because, in a later paper,[35] they account for the beneficial action of adding suitable amounts of organic acids to chrome alum by assuming that these acids prevent the precipitation of the basic salt, which is their way of saying that the organic acids peptize the possible precipitate. On that basis the objection to the chromic chloride solution is that it overdoes the peptization. It is quite evident that Liechti and Hummel did not see this and I am inclined to think that, with our present knowledge, there is danger of reading into their papers a good deal more than they knew was there.

"At a very early period dyers must have noticed that when wool is mordanted with alum alone poor colours are obtained in dyeing, and in order to avoid this defect they began to add, along with it, organic acid, in the form of cream of tartar. No doubt its employment in preference to other acids was the result of pure empiricism, and who the discoverer was is altogether unknown. At the present time one endeavours, wherever possible, to economise by replacing it with the much cheaper oxalic acid."

"In the course of the following experiments it was noticed that when organic acids were employed along with chrome alum for mordanting wool, the green solutions became more and more violet according to the amount employed, from which it would appear that their addition retards or prevents dissociation of the chrome alum. Comparing the effect of equivalent amounts of oxalic and tartaric acids the latter gives greener solutions, and such as show less tendency to become turbid. Closely connected with this is the fact that an addition of oxalic acid to the chrome alum solution only partially prevents its precipitation by caustic soda, whereas an addition of tartaric acid prevents it entirely. Altogether the behavior of these two acids towards chrome alum is somewhat different."

"Six fents of wool were mordanted with ten percent chrome alum plus 0, 1, 2, 3, 4, 5 cc normal oxalic acid (= 0, 0.5, 1.0, 1.5, 2.0, 2.5 mols). With increasing amounts of acid the dissociation apparent in No. 1 liquor diminishes gradually, No. 3 is still fairly turbid, Nos. 4, 5, and 6 are quite clear. The dried mordanted fents appear as follows: No. 1 yellowish-green, No. 2 similar to No. 1 but less yellow, Nos. 3 and 4 are still less yellow, No. 5 has the deepest colour, a greyish-green, No. 6 is slightly paler than No. 5. It is interesting to note that in gas light the mordanted fents exhibit a peculiar reddish tint, and one is tempted to entertain the opinion that the chromium is on the fibre in some peculiar soluble condition. The liquors too, with increase of oxalic acid, acquire a reddish tint, which may possibly be explained by supposing that a part of the chromium has been taken up by the fibre as $Cr_2(SO_4)_3$ in addition to free sulphuric acid, and that in the bath there remains $Cr_2(C_2O_4)$ as well as $Cr_2(SO_4)^3$. This change of colour occurs only during the mordanting process. Notwithstanding the presence of the oxalic acid the hot liquor is first green; but, while the wool gradually acquires a greyish-green colour, the bath becomes more and more violet, appearing distinctly red when cold, quite like the colour of pure chromium oxalate. On heating chrome alum solution with three mols $Na_2C_2O_4$ without the presence of wool, a violet solution is also obtained, showing therefore that interaction occurs at least partially; here the sulphuric acid would be taken up by the NaOH in place of the wool."

"The six fents of the present experiment were dyed with twelve percent alizarin, with the result that No. 5, i. e., the mordant $Cr_2(SO_4)_3 + 2\ H_2C_2O_4$ gave the best colour. Under the microscope No. 1 showed dull red and almost colourless fibres, differences which became less apparent from Nos. 2 to 4, and almost disappeared in Nos. 5 and 6. It may be added that a much deeper claret colour was obtained if the wool mordanted with chrome alum and 2 mols oxalic acid and washed was passed, previous to dyeing, through a very dilute sodium carbonate solution; for 600 cc water 0.53 g Na_2CO_3 (0.005 mols)."

"A further observation may be here cited. The appearance of the waste dye liquor of No. 5 indicated that it contained excess of alizarin and possibly chromium mordant as well, and this proved indeed to be the case, since on boiling in it a small piece of wool (1.66 g) it acquired a pink colour. Wool mordanted with chrome alum and two mols tartaric acid exhausted the dye-bath somewhat more and the waste dye-liquor dyed a piece of fresh wool a paler pink than the foregoing in consequence. Altogether wool mordanted with the addition of tartaric acid seemed to be better mordanted, the yellowish-green tint being replaced by one of a pure greyish-green."

Since oxalic acid and tartaric acid acted so well as additions to chrome alum, Liechti and Hummel tried chromium oxalate and chromium tartrate as mordants. "Chromium oxalate gave much better results than chrome alum and two mols oxalic acid, or than chromium fluoride, and since this mordant is comparatively cheap it may be strongly recommended for use on the large scale. To correct the temporary hardness of the water employed, a little sulphuric acid would require to be added to the bath. A microscopic examination of the fibres supported this favourable view, and it may be added that of all the chromium oxide salt mordant baths that of chromium oxalate was the best exhausted, and the dye bath following it, in the case of alizarin, was almost entirely exhausted."

Further experiments convinced Liechti and Hummel that "the best of all chromic oxide salts as a mordant hitherto examined is chromium tartrate; chromium oxalate is almost as good, and to be preferred in practice because cheaper. . . . . The difference in action between

chromium sulphate and chromium tartrate is truly remarkable, for whereas the former is decomposed almost entirely and scarcely mordants the wool at all, the latter mordants it in the best possible manner. So far as our present knowledge of the wool fibre goes, it seems to us that the cause of this difference lies, first, in the greater affinity of the wool for sulphuric acid, and secondly, that the organic acids are capable of forming much more basic and at the same time soluble compounds than is the case with sulphuric acid."

"Chromium acetate gave an unlevel yellowish-green colour and the dyed colour was very bad. The microscope revealed the greatest differences in colour in the different fibres, although chromium acetate is not dissociated, a fact which shows clearly that wool can only be mordanted properly by chromic salts in acid solution. In the case of chrome alum alone the differences in colour of the individual fibres were very great indeed even in the different parts of the same fibre, but by the addition of oxalic acid these differences became less marked; no colourless fibres were seen, at most such as were greyish blue and bluish-black."

"Chromium fluoride gave an uneven yellowish-green colour; the dyed colour was somewhat better than that given by chrome alum; blue as well as black fibres were noticed under the microscope."

"One point worth noting in connection with wool mordanting in the ordinary manner is, that the less acid the mordanted wool is, the lower the temperature at which it begins to dye. Wool mordanted with chromium oxalate was strongly acid, and began to dye with alizarin only at a temperature of 70° C. As soon, however, as the calculated amount of calcium acetate was added to the bath, the wool began at once to acquire a deep colour and the bath was soon entirely exhausted, although it still had an acid reaction at the end of the dyeing process, having previously passed through a neutral if not even a slightly alkaline condition. It is here plainly evident that the acid previously absorbed is slowly bleeding out of the dye bath."

Adsorption of Chromic Oxide by Silk

Silk does not take up chromic oxide as well as wool does.[36] Liechti and Hummel[37] mordanted wool with chrome alum and obtained a good claret color on dyeing with alizarin; but the green color of the mordanted silk was not as intense as in the check experiment with wool. Knecht, Rawson and Lowenthal[38] say that "for the mordanting of silk with chromium compounds normal or basic chromium salts are used. Bichromate does not serve as a mordant proper, although it is used as an oxidising agent in the developing of cutch browns."

Whittaker[39] says that "in order to preserve the lustre of silk, it is not mordanted in the same way as wool, but in the following way: Mordant the silk overnight in a cold bath of chromium chloride 32° Tw., work half an hour in a cold bath of sodium silicate $^3/_4$° Tw., and wash thoroughly. By this means basic chromium salts are precipitated on the fibre." This is presumably a case of fixing a mordant with silica and will therefore be referred to more in detail in a later paper. The main thing for the moment is that the general principles apply to silk exactly as to wool; but the adsorption by silk is less strong.

Adsorption of Chromic Oxide by Cotton

Cotton takes up chromic oxide very much less readily than silk does. Liechti and Hummel[40] heated cotton with a ten percent chrome alum solution (referred to the cotton) and obtained no mordanting at all. Knecht, Rawson and Loewenthal[41] say that "it is difficult to impregnate the vegetable fibres with an amount of chromium salt sufficient to obtain a full shade. The sulphates, nitrates, acetates, nitrate-acetates, etc., have been employed with good results in calico printing; but the demand for a good chromium mordant for the dyeing of cotton, especially of cotton yarns, has not been completely satisfied as yet." The Hoechst Color Works recommend the use of the so-called chromium chromate, dissolved in or peptized by hydrochloric or acetic acid, and followed by a dilute soda bath. Koechlin[42] has recommended the so-called alkaline chromite solution, which is really chromic oxide peptized by alkali. Knechti, Rawson and Loewenthal say that "Koechlin's alkaline mordant is one of the best chromium mordants for cotton which has been proposed. Unfortunately, it cannot well be used for yarns on account of its caustic action on the hands of the workmen. Another disadvantage is that it cannot be used on oiled material, since the oil would be stripped from the fibre. Cotton piece goods are saturated with the cold liquor on the padding machine, rolled up and left for twelve hours, then washed, if possible in running water. . . . . The precipitation takes place by mere contact, and fixing agents are useless."

The general conclusions of this paper are:

1. From bichromate solutions wool first adsorbs chromic acid and this is then reduced to chromic oxide, which latter forms the true mordant.

2. Within limits, increasing the acid concentration increases the amount of chromic acid taken up. This is less marked with sulphuric acid than with hydrochloric or nitric acid, presumably owing to the adsorption of sulphuric acid by wool.

3. Chromic acid oxidizes organic compounds more readily in presence of wool than when the wool is not there. Sulphuric acid is more effective than hydrochloric or nitric acid in causing the oxidation of wool by chromic acid, possibly because of higher acidity at the surface of the wool.

4. When tartar, oxalic acid, lactic acid, or formic acid is used as an assistant it is possible that there is no appreciable oxidation of the wool.

5. When wool is mordanted with chrome alum, a basic sulphate is apparently adsorbed first. This is said to have

the composition $Cr_2O_3.0.66\ SO_3.xH_2O$. It changes later to chromic oxide, which is the true mordant.

6. Liechti and Hummel found that addition of sulphuric acid increases the amount of chromium taken up; but this is unquestionably faulty experimentation. Increasing alkalinity favors adsorption until the oxide or basic salt becomes too coarse.

7. Liechti and Hummel obtained almost no mordanting with chromium chloride solutions; but this result could undoubtedly have been changed had they added soda.

8. Chrome alum gave uneven mordanting on wool. Since one can get even mordanting with alum, this difference can not have been due to sulphate and must therefore have been due to faulty experimentation.

9. Silk adsorbs chromic oxide less strongly than wool does.

10. Cotton takes up scarcely any chromic oxide from chrome alum; but adsorbs it from an alkaline solution.

11. It is not known why chromic oxide colors wool gray under certain conditions.

12. There is no evidence of any definite compound being formed when wool is mordanted with chromic oxide. It is a plain case of adsorption.

References Cited in "Mordants"—III, Concluded

[34] Jour. Soc. Chem. Ind., 13, 224 (1894).
[35] Liechti and Hummel: Jour. Soc. Chem. Ind., 13, 356 (1894).
[36] Ganswindt: "Theorie und Praxis der modernen Färberei," II, 19 (1903).
[37] Jour. Soc. Chem. Ind., 13, 223 (1894).
[38] "A Manual of Dyeing," 258 (1910).
[39] "Dyeing with Coal Tar Dyestuffs," 50 (1919).
[40] Jour. Soc. Chem. Ind., 13, 223 (1894).
[41] "A Manual of Dyeing," 252 (1910).
[42] Dingler's Polytech. Jour., 254, 132 (1884).

Sodium Peroxide a Bleaching Agent

Properties of Sodium Peroxide—Composition—Handling—Bleaching of Piece Goods—Various Applications —Preparation of Bleach Liquor—Methods of Bleaching—Baths Used in Peroxide Bleaching

By WILLIAM B. NANSON

SODIUM dioxide or peroxide, Na_2O_2, is obtained when the metal is burned in an excess of air or oxygen. It is now made on the large scale according to Kastner's process, which consists in placing sodium on aluminum trays loaded onto small wagons, which are then run through an iron tube, provided at each end with tightly closing iron doors, set in a furnace heated to 300 deg. A current of dry air, free from carbon dioxide, is passed through the tube, the peroxide produced being withdrawn at one end and fresh charges of sodium being introduced at the other. The technical product thus obtained contains about 90 to 93 per cent of sodium peroxide.

The peroxide as it comes into the market is a yellowish mass, partly powdered. On adding water to a small quantity any particles of metallic sodium present will ignite. Its powerful oxidizing action in the presence of water presents several dangers. Thus, for instance, it may be warmed with aniline or benzene, in the absence of water, but on the addition of water the mixture (if particles of metallic sodium be present) at once takes fire.

Properties of Sodium Peroxide

It absorbs carbon dioxide with the formation of sodium carbonate and liberation of oxygen, and a mixture of this oxide with potassium peroxide is used in life-saving apparatus to regenerate air contaminated with respiration. With CO it yields sodium carbonate, and with N_2O and NO sodium nitrite.

Although sodium peroxide is not decomposed when heated alone it readily gives up oxygen to other substances mixed with it, and is therefore largely used in the analysis of many refractory minerals, such as pyrite and chromite. As fused sodium peroxide acts most energetically on platinum, iron, etc., it is necessary to use crucibles of nickel as this is less attacked than the other metals.

Sodium peroxide is soluble in water (causing a visible rise in temperature) and possesses a strongly alkaline reaction. When dissolved in dilute mineral acid it yields hydrogen peroxide. Peroxide of sodium cannot, on account of its alkalinity, be employed directly for the bleaching of animal fibers, such as silk or wool. For these it is used as a source of hydrogen or magnesium peroxide. In the latter case a solution of three parts of magnesium sulphate (free from chlorine) and one part of sodium peroxide is used; after treatment with which the goods are treated with dilute acid and washed well with water.

Sodium peroxide dissolves readily in water with the formation of caustic soda and hydrogen peroxide, a portion of the latter simultaneously undergoing decomposition into water and oxygen owing to the heat evolved during the solution.

By exposing the peroxide to moist air free from carbon dioxide, or by the cautious evaporation of its solution in cold water, tabular hexagonal crystals of a hydrate Na_2O_2, $8H_2O$ can be obtained, which on standing over sulphuric acid lose water, forming the dihydrate Na_2O_2.

$2H_2O$. The octohydrate is also produced by adding one and one-half to two times its volume of alcohol to a solution of caustic soda and hydrogen peroxide. The hydrate dissolves in cold water without decomposition, but on heating the solution, oxygen begins to be evolved at 30 to 40 deg. Cent., the decomposition of the salt being complete at 100 deg. Cent.

Sodium peroxide is employed as an oxidizing agent, as a source of oxygen in the laboratory, and in the preparation of bleaching solutions containing hydrogen peroxide.

The following method may be used for the analysis of sodium peroxide: About 0.25 grams of the sample is introduced into the dry tube of a nitrometer flask, and about 5 c.c. of water (containing a few milligrams of precipitated cobalt sesquioxide in suspension) are placed in the flask itself.

Rapid and complete decomposition of the sodium peroxide results immediately it is brought into contact with water and the volume of the oxygen evolved is the available oxygen contained in the weight of peroxide taken.

Composition

A sample of the commercial substance tested by this method gave in three experiments, 18.54, 18.46 and 18.51 per cent of available oxygen. The same sample contained 78.66 per cent of sodium oxide, and 0.49 per cent of alumina and iron oxide. Therefore the calculated composition was:

Sodium peroxide (Na_2O_2)	90.41 per cent
Caustic soda (NaOH)	8.73 per cent
Alumina and oxide of iron.....	0.49 per cent
Undetermined	0.37 per cent

This sample contained a very little carbonate, a trace of chloride, a minute trace of sulphate, and a few particles of unoxidized metallic sodium.

It has been shown that sodium peroxide decomposes in contact with water with the formation of sodium hydrate and hydrogen peroxide thus: $Na_2O_2 + 2H_2O = 2NaOH + H_2O_2$, and I would say that with acids a similar reaction takes place thus: $Na_2O_2 + H_2SO_4 = Na_2SO_4 + H_2O_2$. When exposed to a moist air it gradually decomposes, the hydrogen peroxide being lost. If it be left in contact with inflammable material, such as cotton or wool, sufficient heat is often developed to cause ignition. On this account sodium peroxide should never be allowed to lie about on a floor, and should be carefully preserved in air tight drums or tins until required. The commercial article contains from 19 to 20 per cent of available oxygen. Its chief impurities are iron oxide, alumina, and occasionally metallic sodium. The latter should be carefully avoided, since it reacts with water, forming hydrogen gas.

Handling

If sodium peroxide be added without caution to water considerable heat is evolved, the temperature rising sufficiently to cause the decomposition of the hydrogen peroxide produced. In preparing a bleaching solution, therefore, the peroxide should be added slowly to cold water with constant stirring, the temperature never being allowed to rise above 30 or 40 deg. Cent. Sodium peroxide powder is very irritating to the mucous membrane, and should be added as carefully as possible to the water to prevent its being scattered or inhaled. The solution thus obtained contains hydrogen peroxide corresponding in amount to the peroxide of sodium used.

The regular evolution of hydrogen peroxide is favored by alkalinity and moderate heat, but to insure the gradual liberation of the bleaching agent it is necessary to control these factors. If, however, the sodium hydrate formed by the decomposition of the peroxide is allowed to accumulate, it may cause damage to the fabrics and give them a harsh feel when finished. After solution of the peroxide of sodium the alkalinity is generally neutralized with sulphuric acid and a slight excess of acid added. The bath is then brought to a state of faint alkalinity by means of ammonia. Sodium silicate is sometimes used to neutralize the acid, but it is not so good as ammonia. Sodium and ammonia phosphate, with or without ammonia, are also employed in making up the bath and frequently magnesium sulphate (Epsom salts). The latter body is weighed out in the proportion necessary to neutralize the liberated caustic soda, dissolved in a little water, and slowly added to the bath with constant stirring. It reacts with the sodium hydrate, producing sodium sulphate and magnesium hydrate thus: $2NaOH + MgSO_4 = Mg(OH)_2 + Na_2SO_4$.

Magnesium hydrate has no action on animal or vegetable fibers, and the bath can be used just as it is. When magnesium sulphate is used, a bath of sulphuric acid should always be employed afterwards, to dissolve any magnesia adhering to the goods, followed, of course, by a thorough washing with water. It is also necessary to see that the goods are free from soaps, or magnesium soaps will be formed which will protect the fibers of the goods from the action of the peroxide. The peroxide should always be dissolved in a separate vessel and allowed to settle, the clear liquor being drawn off into the bleaching vat. In this way the greater part of the impurities are removed. Thus iron oxide and alumina will have been precipitated as hydrates or phosphates. The clear solution is then heated in the vat to a temperature of about 40 deg. Cent. and the goods entered.

Bleaching

Where piece goods are being bleached it is advisable to have some mechanical form of dolly or winch with which they can be worked, or to insure continual circulation of the liquor by means of a pump. This is very important, since, in the absence of this precaution, there is insufficient circulation and the weight of the goods often prevents their thorough saturation or the removal of the used liquor, and uneven bleaching results. As a rule the

goods should be worked continuously for about three hours, after which they may be left for a further period of twelve hours. The bleaching vat must be provided with a perforated tap, which can be fixed in such a way as will insure that the goods are completely immersed, and the volume of water must, of course, be sufficient to allow of this.

The reaction of the liquor should be tested from time to time and, if necessary, corrected. It is also desirable to test the strength of the liquor with regard to hydrogen peroxide and, if necessary, to strength the bath. In the absence of this precaution it sometimes happens that the liquor becomes so weak that bleaching ceases. After being thoroughly saturated with the liquor, goods are sometimes taken out and exposed to the air to complete the bleaching. This, however, must never be done with cotton goods, and the writer does not approve of it under any circumstances.

Good White on Wool

Sodium peroxide is adapted for bleaching wool (loose wool, yarn or fabric) mixed fabric (half wool and half silk), silk (chappe, bourette, tussah), hair, straw, ivory, etc., a very pure and permanent white being obtained, in contrast to the merely temporary bleach furnished by sulphur dioxide, especially on wool. Owing to its considerably higher price than bleaching powder, sodium peroxide is often thought of less importance in the bleaching of cotton, though it is used for half-woolen goods. With these latter fabrics sulphur bleaching is attended with some difficulties, the cotton being more or less tendered by the sulphurous acid, in consequence of which the addition of alkalis is necessary. These, however, are inadmissable on account of their corrosive action on the wool; whereas sodium peroxide does not injure either kind of fiber, and can therefore be used for bleaching the mixed fabric.

Sodium peroxide is also used for fine cotton goods and laces, and fine cotton or mixed hosiery and underwear.

For fine cotton goods, laces, hosiery, etc., the following bath may be used:

100 gallons water.
10¼ pounds sulphuric acid of 168 deg. Tw.
8 pounds sodium peroxide.
¼ pound sodium phosphate.

Before introducing the goods, sufficient ammonia is added to produce a slight alkalinity to the bath when tested with litmus paper. The bath is gradually heated to 50 deg. Cent. when the goods are entered and worked.

Other Applications

In addition to the foregoing textiles, sodium peroxide is suitable for bleaching straw, felt, wood, horn, Malacca cane, bones, ivory, bristles, sponges, wax, fats and oils. All the substances to be treated must first be thoroughly cleaned by means of soap or other detergents.

In the case of wool or half wool it should be noted that unless completely freed from fat the material will not bleach. The best detergents in this case is a solution of ammonia, this alkali making the wool bright and preserving its natural softness. Ammonia being volatile, there is no risk of its remaining in the wool after the cleansing process. Potash or potash (potassium carbonate) soap may also be used for cleansing wool, the natural softness of which is retained under this treatment, whereas sodium carbonate makes the fiber hard. An excess of alkali should be avoided especially for fine wool, since it makes the wool yellow, which yellow tinge is a fast color and cannot be afterward eliminated by the sodium peroxide, or in fact any other bleaching process.

Cotton goods must be thoroughly bottomed, steeped overnight in diastafor, soured, washed, boiled eight hours in a 4 per cent solution of 40 parts soda ash, 55 parts caustic soda, 5 parts soap, washed, soured and washed.

For woolen, worsted or merino yarns or piece goods the use of ½ to 1 per cent of Marseilles soap along with a little ammonia is recommended, while for the second washing the water should contain a little ammonia and about ½ per cent of Turkey red oil.

For carpet yarns or other woolen yarns of very low quality about 1 to 2 per cent of sodium carbonate, with a little soap and about ½ per cent of Turkey red oil seems about right, it being desirable to free these from fatty or greasy matters as cheaply as possible before bleaching.

Since metals and metallic salts exert a catalytic action on the bleaching liquor, and therefore cause the liberation of oxygen to proceed too rapidly, the bleaching liquor should always be prepared in a perfectly clean and well bleached wooden vat, an enameled pan being used when the quantity is small. Where direct steam is used for warming the liquor—as in small plants or trial bleachings—lead or earthenware pipes alone are suitable, cast iron pipes being barred on account of their liability to rust.

At a sufficiently low temperature sodium peroxide dissolves in water containing acids, hydrogen peroxide and the corresponding sodium salts being formed. In most bleaching processes for wool, silk, etc., the sodium peroxide must be dissolved in acidified water, in order to neutralize the caustic soda, which would otherwise tender the fiber. If sulphuric acid be used for this purpose, the neutralization proceeds in accordance with this equation: $2NaOH + H_2SO_4 = Na_2SO_4 + 2H_2O$, the solution then contains sodium sulphate, which has no weakening influence on the fiber. Pure water alone must be used for dissolving peroxide of sodium, and the acid used must also be pure, because in the case of impure water a certain amount of oxygen would be wasted for the oxidation of the impurities.

The water used for making the bleaching liquor should also be as cool as possible, this being a condition essential to the preparation of a solution containing caustic soda and hydrogen peroxide at the same time.

Warm water causes the liberation and consequent waste of the oxygen from the peroxide and a considerable rise in temperature always occurs during the dissolving of the sodium peroxide, and care (and ice if necessary) must be used to keep it down.

Preparation of Bleach Liquor

The bleaching liquor is usually prepared by sprinkling the sodium peroxide powder, from a kind of dredger, into the already acidified water, in small quantities at a time, care being taken to keep the water in motion by stirrers and agitators. Among other disadvantages, the addition of larger quantities of peroxide to the water at any one time is attended with considerable waste of oxygen. Sodium peroxide is neither combustible nor liable to spontaneous combustion.

By itself, sodium peroxide cannot be exploded by precussion or shock, or even by the heat of the blowpipe flame, though on account of its powerful oxidizing action on most organic substances it is capable of igniting cotton, wool, straw, etc., especially in the presence of moisture. In adding sodium peroxide to the bath, care must be taken to see that none of the powder is spilled, or, in the case of a bleaching kier, dropped between the false bottom or sides and the lead coil. The powder must be taken out of the drum or tin by means of a clean metal scoop, which must be perfectly dry, to prevent any decomposition of the peroxide. For the same reason the drum, etc., must be tightly closed after any of the powder has been taken out.

Before entering the goods to be bleached the liquor must be tested with litmus paper and if the liquor is neutral or acid it must be rendered alkaline.

The bleaching vat should be of hard white wood or slate, made in such a way that no iron or other metal can come in contact with the bleaching liquor. The only metal which is safe to use is lead, but wood is better. A new vat and all its fittings which are likely to touch the liquor or the goods must be well boiled out with soda ash and washed and then thoroughly soaked with sodium peroxide solution at ½ per cent containing 0.675 per cent of commercial sulphuric acid. Enough of this solution should be used to fill the vat or kier to above the level of the frame which holds the goods down under the liquor, the idea being to remove any impurities and coloring matters present in the new wood. The temperature is raised to 140 deg. Fahr. and allowed to stand overnight. Next morning the contents are raised to boiling point; the vat or kier is then run off and washed out well, and it is then ready for permanent use.

The vat or kier is heated by means of a lead steam coil, placed under a false bottom, entering at one end, coiling backwards and forwards, and finally going out at the side or end. An open steam pipe should never be used. The false bottom above the steam pipe prevents the goods from coming in contact with the pipe, and also allows any suspended solid matter to settle out. A movable perforated top is provided, which can be fixed just beneath the surface of the liquor, thus insuring the complete immersion of the goods into the bleaching liquor. For piece goods a suitable dolly or jigger may be used. In practice it is generally found convenient to work with 15 to 20 parts of water to one of goods.

Methods of Bleaching

Wool, wool felt, half wool (cotton and wool) fabrics, woolen yarn and woolen plush, can be bleached in the following manner: The goods are first thoroughly cleansed of all impurities by scouring with soap and ammonia or sodium carbonate, and well rinsed with clean water.

To every 100 parts (by weight) of water, which must be free from iron, add 0.675 part of commercial sulphuric acid (66 deg. Baume), stirring this in well, and then sprinkle 0.5 part sodium peroxide in small quantities into the liquid, taking care that the whole of the peroxide is dissolved completely. The resulting liquor has a faintly acid reaction, and must be rendered alkaline to red litmus paper by the addition of pure potassium silicate (or ammonia) before the goods are entered. The temperature of the bleaching liquor should be raised to 122 to 131 deg. Fahr., and maintained at that for from three to five hours by which time the bleaching will be complete. The goods are next thoroughly rinsed, then soured with a little acetic or sulphuric acid and rinsed thoroughly again with clean water.

During the bleaching process the reaction of the bath should be tested at intervals by means of red litmus paper (which should turn blue on immersion in the liquor) and if found to be acid must be rendered alkaline again by a fresh addition of silicate or ammonia.

The bleaching liquor is usually not quite exhausted by one operation, and may be used for bleaching a second or even third batch of goods by carefully adding fresh liquor.

The foregoing bleaching liquor forms a ½ per cent solution of sodium peroxide. For a 1 per cent solution the quantities of acid and peroxide must be doubled, and so on in proportion for all stronger solutions. In adding the potassium silicate to make the liquor alkaline care must be taken to prevent the undiluted silicate from coming in contact with wool, since it tenders the fiber; and this risk is also incurred when the liquor is too strongly alkaline (ammonia is the safest). In the aftertreatment of the bleached goods it is advisable to work them in a soap bath, charged with a good textile soap.

Sulphuric acid may be replaced by an equivalent quantity of magnesium sulphate, which must be free of chlorine, the goods being entered into water at 86 deg. Fahr., containing an amount of magnesium equal to 30 per cent that of the goods. After remaining a short time in this liquor the goods are taken out, and 10 per cent of sodium peroxide, calculated on the weight of the goods, is slowly

added to the liquor. The goods are then re-entered and left in the bath, at a temperature of 122 to 140 deg. Fahr., for two or three hours, after which they are taken out again, rinsed with water, acidified with sulphuric acid, and then rinsed again, until free from all acid in clean water.

When sodium peroxide is used in conjunction with magnesium sulphate the reaction proceeds in accordance with the following equation: $4MgSO_4 + 4NA_2O_2 + 7H_2O = 4Na_2SO_4 + MgO\ (OH)_2\ 3MG\ (OH)_2 + 3H_2O_2$.

Sodium sulphate, hydrogen peroxide, and magnesium perhydroxide being formed. The last named compound is particularly important in the case of goods that are difficult to bleach, owing to its comparative stability when heated.

Baths Used in Peroxide Bleaching

The following are a few types of baths employed in peroxide bleaching:

1. Sulphuric acid and ammonium phosphate bath:
   Water 98 liters.
   Sulphuric acid, 16 deg. Baume, 800 grams.
   Ammonium phosphate, 300 grams.
   Sodium peroxide, 350 grams.

2. Sulphuric acid bath:
   Cold water, 100 liters.
   Sulphuric acid of 66 deg. Baume, 1.35 kilos.
   Sodium peroxide, 1 kilo.
   The whole being made faintly alkaline with ammonia.

3. Magnesium sulphate bath:
   Cold water, 95 liters.
   Magnesium sulphate, 3 kilos.
   Sodium peroxide, 1 kilo.
   To be used as generally described in the body of this article.

Bleaching Silk.—The amount of sodium peroxide used for silk is 12 per cent instead of 10 per cent, while 30 per cent is used for tussah silk. The liquor is heated to 167 to 194 deg. Fahr. for this material; but in other respects the operation is conducted in the same manner as for wool.

Articles of white silk such as ribbons or silk and cotton mixtures (cotton with silk stripe mixtures, etc.) can be effectually bleached somewhat as follows: All goods must be thoroughly cleansed with lukewarm soap first, and washed in warm water. The bleaching liquor into which they are next entered is prepared by dissolving 200 parts by weight of magnesium sulphate in 18,000 parts of cold distilled water, 56 parts of sodium peroxide being stirred gradually and carefully into the solution and followed by 72 parts sulphuric acid. The liquor should be faintly alkaline, and maintained at a temperature of about 167 deg. Fahr., the goods being left in it for three to four hours and moved about from time to time. After removal from the bath the goods are placed in lukewarm water, acidified with sulphuric acid and containing a little bluing. They should be rinsed and before finishing should be passed through a solution of gelatine containing a little acetic or citric acid for scroop.

The quantities of materials given in this article are only given as indicators; they are liable to vary under local and other conditions, even some of the recipes given apparently vary, being from different localities and used under different conditions. Each peroxide manufacturer, however, has his own formula and can give his clients the best dope for his own product. The author's idea is to present the general conditions.—Cotton.

DYES AND THEIR NAMES

Dyestuff nomenclature is quite rightly a standing grievance of all of us who have to use color. The trouble may be said to have originated with the German firms who insisted each on having its own distinctive prefix, which should designate the class to which the color belonged as well as the firm which made it. This was not too bad. A diamine color was a direct dyestuff manufactured by L. Cassella & Co., and so on. Unluckily, however, the main classes of dyestuffs quickly became subdivided as color groups were discovered possessing slightly different properties from the original range. Thus another word was added to those already in use. Where it was merely a case of "fast" and "brilliant," such as diamine fast yellow or brilliant benzo blue, the designation was made for an obvious purpose, the idea was successfully conveyed and no one can reasonably have been confused. Later came the "diazo" colors, the "para" colors, the "fast to light" colors; after treatment accounted for a few more distinguishing marks, and the astonishing fact emerges that one firm of German manufacturers alone had in 1914 no less than thirty-six different ways of naming substantive colors exclusive of shade marks (such as "B," "4GL," etc.). There were at that time six major and three or four minor firms, all engaged in the manufacture of roughly the same dyestuffs, competing with each other in the selection of pleasant or high-sounding distinctive names for their own particular offspring, with the perfectly natural result that dyers and colorists had lost touch or had lost count. Cases were not unknown where the firms' own travelers, who had inadvertently left their reference books behind, had failed to recognize their own trade names. This confusion was in reality bad for the color makers. People refused to buy colors which could advantageously replace those in use for no other reason than that the name was strange and complicated. Occasionally a new color floated into immediate popularity, but in the main the dyer preferred to go on using the old color, with the net result that by far the greater proportion of new colors placed on the mar-

ket never achieved a sale which made their manufacture a profitable undertaking. It is not contended that the German works did not overproduce so-called novelties which had little or no claim to general adoption, but an additional resaon for the failure of many new types of color was undoubtedly their unnecessarily complicated nomenclature.

Since the war, matters have gone from bad to worse. All or most of the original German brands are still on sale, and in addition all the works in this country and America have concocted a new series of names, to the still greater confusion of the unfortunate buyer. We have been spared the necessity of learning many American names by economic circumstances which do not permit American works to export in bulk to this country. In view of their strange and apparently irrelevant sounds, one is not unthankful. "Amanil," "Osfanil," "Awieo," "Erie," are some names taken at random from a list of American specialties prepared by Dr. Merritt Matthews. His list of some 230 different trade names by no means includes them all.

It is too much; it is even futile, for the end has got lost in the means. Words that were coined to distinguish have only served to confuse.

The complication of names has, however, gone on unchecked for so long that it is not easy to suggest a method by which the issue can be simplified, for it is only fair to recognize that certain colors have always been popular and have come to be regarded as indispensable. Their names, too, are known in every corner of the world where dyeing is practised. It would be manifestly unfair to invite the proprietors of these names to throw them into a common pool. But there are, on the other hand, hundreds of names with which the dyer is acquainted only through the medium of the handbooks lavishly distributed by the German firms before the war. The limited application which many of them found is a proof that their names were no particular attraction.

There would be little or nothing to lose by merging them into a general classification which, with a distinguishing mark for the manufacturing firm, would show the buyer immediately the type and properties of any dyestuff under review.

A further source of irritation is the arbitrary labeling of colors with shade marks. Here, again, there is no system. It might reasonably be supposed that a red "6B" would be bluer than a red "4B." Assume both colors to be of the same class, manufactured by the same firm, and it usually is bluer. If, though, the colors are of a slightly different character, anything may happen. If they are made by different firms, the marks are useless for comparison unless the brands are exceptionally well known. That is to state in effect that where patent rights have run out and manufacture has become common the competing firms have given their imitation product a name and mark not so dissimilar to the original as to obscure the fact that the new color has a relation to something already well known. The motive here is obvious, but we have only that to thank for any little system that can be discerned.

Now that the world's capacity for color production is from two to two and a half times the largest possible steady consumption, it seems clear that the majority of factories must manufacture much less than their maximum, while others will probably close down altogether. There is the additional possibility that following the precedent of arrangements concluded with France and Italy the German interests will reach a working agreement with British makers. The Germans themselves are much more closely bound together than they were before the war, and there is considerably less competition between them.

With these three favorable factors operating towards simpler working, is it too much to hope that when the time is ripe the manufacturers concerned will take pity on the unfortunate user and try to evolve some order out of the present chaotic conditions of dyestuff nomenclature?—Textile Recorder.

HIGH POLISH FOR COTTON YARN

A high polish on yarn is usually obtained by means of friction, says Textile World. Waterproofing varnishes are common, the most useful being made from shellac. After being applied to the yarn or thread and dried, the latter is subjected to friction to develop the luster. Another waterproofing substance is Japan wax. This is dissolved in water with the aid of crystal soda. The proportions follow: Water, 1 gallon; Japan wax, 3 pounds; crystal soda, 1 pound. The exact strength of this solution must be determined according to the conditions of its use. For some purposes it is diluted with starch paste, but it is believed that for the present purpose this would not be satisfactory. Caseine, in the form of a solution made with ammonia, seems to be practical for the purpose. It not only takes a luster, but it is waterproof to a great extent. A caseine solution is prepared as follows: The caseine is stirred up with a little water to make a thin paste, then add one-tenth of ammonia or borax on the weight of the caseine. The resulting solution is to be diluted to the proper consistency. Another method of waterproofing which when finished will take a polish is to prepare a solution of gelatine in water of the proper consistency, impregnate the thread with it and afterward treat with a solution of chrome alum or formaldehyde. This will effect a hardening of the gelatine, permitting imparting a luster when finished.

According to B. P. 186,878, British Dyestuffs Corporation prepares new intermediates by treating nitroso-derivatives of oxyalkyl-arylamines or oxyalkyl-alkylaryl-amines, or *m*-thydroxy-oxyalkylarylamines or *m*-hydroxyoxy alkylalkyl-arylamines by treatment with nitrous acid, and in the case of secondary amines transforming the nitrosamine with hydrochloric acid.

NOTES ON BACKCLOTHS

By Raffaele Sansone

BACKCLOTHS support the cloth in the printing machine, prevent the blankets from being dirtied and the patterns from smudging.

Any error in the position of the backcloth may create friction under the fabric, and if this moves to the right or left even a sixteenth of an inch this movement is quite sufficient to spoil the pattern. As a rule, therefore, the fabric is placed over the backcloth while this is being stretched and opened out in the usual way before printing.

Backcloths are usually cloth with sufficient strength to stand the working strain of the printing operation. After cleaning they are usually printed or dyed in dark colors. This prevents waste, as constant use of the cloth in the form of a backcloth would soon wear it out.

When their texture permits it, highly sized gray fabrics can be used as backcloths without requiring any preliminary treatment for even longer than is usually practised, as they can be little by little liberated of their size and require only a very short boiling out, or even no boiling out whatever, to bring them under suitable conditions for bleaching, dyeing, padding or printing.

Few practical men consider the nature of the fabrics used as backcloths, and this is a mistake. If the same are too fine, a certain deterioration of the material takes place, while the blanket is little protected and the color paste dirties it nearly in the same manner as if no backcloth were employed. If, to the contrary, the backcloth is too thick and contains projecting lines warpways, weftways, or in both directions, and fine designs have to be printed, the cloth assumes over its surface, when pressed against the cushion formed by the blanket, and wadding covering usually placed round the pressure bowl, a series of curves separated by small grooves, that render all effects produced irregular.

Some printers dry the backcloths before re-employment. This is of advantage with light patterns; but when heavy patterns are to be produced on light cloth, or when the backcloth is employed on the duplex printing machine, it only complicates matters, as the hardened color paste, that might be deposited on the surface of the material, produces irregular effects on the cloth printed just above and renders the cleansing operations more difficult. For this reason, in well-organized works the backcloths are washed directly they leave the printing machine, so that the wet color paste they contain on their surface can be easily washed out.

A type of backcloth washer consists principally of a wooden or iron vat, on the bottom of which are fixed a series of narrow wooden rollers, so arranged as to work below the liquor used for treating the goods. On the top of the vat are placed the corresponding numbers of squeezing cylinders, in such a manner that the cloth on coming from the rollers below is squeezed between each impregnation. It is treated on this apparatus with a warm sodium carbonate bath kept at the boil. Although the extraction of the color paste is never completed on this apparatus, it is sufficient for many purposes, and the cloth as it leaves the same can be simply dried on drying cylinders and used again on the printing machine. The washing and drying operations on each backcloth are repeated as may be convenient.

The backcloths are either changed when dirtied after each passage through the printing machines, or are used over and over again until they are too dirty. This system of continually changing the backcloths is that generally practised everywhere. The backcloth is brought on a wooden shaft before the printing machine, where it is joined to the backcloth to be changed. When the machine is started for the first time the task of the printer offers a certain difficulty, for he has to stop the machine, raise the engraved rollers, and pass the backcloth under the cloth to be printed, avoiding the formation of creases or plaits, which would cause irregularities in the patterns.

If the pressure bowl is supplied with a tape, the operation is greatly facilitated. If there is no tape, the end of the backcloth is pinned to the blanket as it enters and is thus drawn round the bowl, where it is spread out till all creases or plaits disappear. It is then wound on the shaft which draws it out of the machine during working.

In this process the continuity of the printing lasts as long as the backcloth, unless the printer is able to paste together the end of the finished backcloth and the front edge of the next piece to be treated, so as to draw the new piece through without stoppage. This task is difficult, however, and many printers prefer to stop the machines as each piece is finished rather than run the risk of spoiling the accuracy of the designs, which would invariably occur if too much starch were used in joining up, or if through an imperfect join the pieces separated during the running of the machine. Should this happen, the printer would have to enter the backcloth by fixing the blanket as described, while several yards of the printed goods would have been spoiled.—The Textile American.

DYEING MIXTURES CONTAINING CELLULOSE ACETATE SILK

DR. RENE CLAVEL has taken out a patent (182,844) for dyeing woven or knitted union or mixed fabrics consisting partly of cellulose acetate, and partly of cotton, linen, artificial silk of the cellulose type, wool or other threads, or fibers or filaments, natural or artificial. silk, film, or other form, which is based on the discovery that certain groups—[illegible]yl groups, amino groups, imino groups, imide g[illegible]vn the union [illegible]ro groups, are

active in the sense that they enable the dyestuff to enter the chemical reaction or combination with the cellulose acetate, and that these dyestuffs, whether of the direct, acid, basic, vat or other class, and whether soluble or insoluble in water, will dye cellulose acetate silk.

According to the present improvement the fabric is dyed with a direct, mordant, acid or other dyestuff appropriate for the cotton, linen, wool or other non-acetate portion of the fabric, and non-active or insufficiently active for the cellulose acetate, and the cellulose acetate portion of the fabric with a dyestuff of the active character referred to. An alternative is to dye both the cellulose acetate portion and the non-acetate portion with a dyestuff suitable for dyeing the non-acetate portion and having the active character which renders them capable of dyeing the acetate portion.

Where different dyestuffs are used for dyeing the acetate and non-acetate portions of the fabric, their colors or shades may be matched or appropriate to each other, so as to obtain solid or uniform shades on the union or mixed fabric or dyestuffs of different colors or shades may be employed to obtain differences of color or shade between the cellulose acetate portion and the non-acetate portion.

Separate dye baths may be employed for the dyeing of the respective portions of the fabric, or a single dye bath may be used containing both a dye bath suitable for the non-acetate portion and a dyestuff or dyestuffs of the active character for the cellulose acetate portion; or a single bath may be employed containing a dyestuff of the active character which is also suitable for the non-acetate portion of the fabric.

When separate dye baths are used for the different portions, the order of dyeing the respective portions may vary, either the non-acetate portion or the acetate portion being dyed first, the material being washed between the respective dyeings.

The dyed fabric may, with advantage, be treated with a bath containing an organic acid, such as formic or acetic acid and oil emulsion; for example, one consisting of olive oil and olive oil soap.

By way of illustration the union or mixed fabric may be dyed with a direct, mordant, acid or other dyestuff or dyestuffs appropriate for the cotton, linen, cellulose silk, wool or other threads, filaments or fibers of the fabric, which do not possess the active character at all or sufficiently for dyeing or adequate dyeing of the cellulose acetate, and then the fabric or the cellulose acetate portion with a selected dyestuff or dyestuff of the active character, of a color or shade matched or appropriate to that of the dyestuff or dyestuffs used for dyeing the cotton or other portion of the fabric, the dyeing with the active dye or dyes being carried to the necessary point to attain solid or uniform shades on the union or mixed fabric, or it may be any desired difference of relative shade between the cellulose acetate portion and the other portion of the fabric.

For instance, a union fabric consisting partly of cotton and partly of cellulose acetate silk may be first dyed up with a sulphonated direct dyestuff and then after washing, be dyed in a bath of a selected dyestuff of the active character referred to, approximating in color or tone to that of the cotton dye, the dyeing being continued in the second bath till a solid shade has been obtained on the union fabric.

Instead of dyeing first with the dyestuff inactive or insufficiently active to cellulose acetate and afterwards with the dye active thereto, this procedure may be reversed, or both classes of dyestuff may be used in a single bath for dyeing the cellulose acetate and non-acetate portions in one bath, or a dyestuff or dyestuffs of the active character may be used for dyeing both the acetate portion and the non-acetate portion of the fabric in one operation or separately.

In any case, the dyeing of the cellulose acetate portion of the fabric, whether in a separate bath or in a single bath with the other portion, may be effected with salts such for example as magnesium chloride, stannous chloride or zinc chloride, which are capable of forming double salts with basic dyestuffs. These salts may especially be used where non-sulphonated or mono-sulphonated basic dyestuffs of the active character are employed for dyeing the cellulose acetate.

Example I.—A dye bath of a direct cotton dye is prepared as usual, and a union fabric of cotton and cellulose acetate silk is worked in this until the cotton has been dyed sufficiently. The fabric is then washed and is transferred to an aqueous dye bath containing Induline in suspension in presence of acetic acid, and is treated in this bath at about 60 to 70 deg. Cent. until the cellulose acetate is dyed to the same shade as the cotton, or to a desired different shade. The dyed fabric may then be washed in a bath containing acetic or formic acid and oil emulsion consisting of olive oil and olive oil soap, at about 15 to 35 deg. Cent.

Example II.—A union fabric of cotton and cellulose acetate is dyed in a way similar to Example I, except that the order of the baths is reversed, the fabric being first treated in the Induline bath and then, after washing, in the bath of the cotton dye.

Example III.—A union fabric of tannin-mordanted mercerized cotton, or tannin-mordanted cotton, and cellulose acetate silk is treated in a single aqueous dye bath of a basic dyestuff possessing the active character before referred to, e. g., Fuchsine at a temperature of about 60 to 70 deg. Cent. until a desired depth of shade is obtained on the whole fabric. The dyed fabric can then be washed in a bath of acetic or formic acid and oil emulsion consisting of olive oil and olive oil soap, at about 15 to 35 deg. Cent.

In any of these examples a salt of the kind capable of forming a double salt with basic dyestuffs may be added in a proportion of, say, about 300 grams per liter, to any of the baths in which the acetate portion is dyed separately or together with the other portion.

The dyeing may in any case be performed in a foam bath or in a water bath.—Dyer.

OXYCELLULOSE: ITS FORMATION AND REACTIONS

(*Continued from page* 410.)

of standard conditions in order to obtain comparable results. Figures are given in the following table:

Observer	Oxycellulose — Source	Oxycellulose — Agent	"Copper No."
Schwalbe & Becker[50]	Cotton	Hypochlorite	11.0
Schwalbe & Becker[50]	Cotton	Permanganate	8.0
Schwalbe[54]	Filter paper	Bleaching pdr.	7.9; 7.6
Schwalbe[54]	Cotton	Hydgn. peroxide	5.8
Dorée[55]	Cotton	Ozone	14.96; 16.9
Oertel[46]	(?)	Electrolytic	39.5 (max.)

Knecht[56] and Hagglund[54] have suggested modifications of the procedure adopted by Schwalbe.

The reduction of solutions of other metallic salts has also been described. Thus Dietz[25] observed that oxycellulose in Nessler's solution at the ordinary temperature was colored brown at first, and then rapidly assumed a gray color; the intensity of color was proportional to the yellow color obtained with alkalis.

In addition, Harrison[57] has recommended a reagent containing 1 per cent silver nitrate, 4 per cent sodium thiosulphate, and 4 per cent sodium hydroxide, with which the material to be tested is boiled or steamed, the presence of oxycellulose or hydrocellulose being shown by the formation of stains. The effect is enhanced by previous treatment with a hot 1 per cent solution of phenylhydrazine in glacial acetic acid followed by thorough washing with dilute acetic acid. Finally, Knecht[20] states that oxycellulose prepared by the action of potassium permanganate reduces ferric salts.

(C) Dyeing Tests

The increased affinity of oxycellulose, compared with cellulose, for basic dyes was first observed by Witz,[1] who protected oxidation as a means of obtaining specialized dyeing properties.[5] The affinity for methylene blue, in particular, has been largely used both qualitatively and, for comparative purposes, quantitatively. Nishida[58] has determined the excess of the dye by titration with titanous chloride, while Vignon,[59] Doree,[27 36 37] and others have used a colorimetric method. Kita,[69] however, has impugned the quantitative value of the test, as he considers that the quantity of dye adsorbed is influenced by the degree of subdivision of the substance under examination and that there is no proportionality between the quantity of oxycellulose and the amount of methylene blue adsorbed. Rona and Michaelis[90] consider that the mineral matter in cotton acts as an adsorbent for methylene blue, so that this effect must be taken into account in measuring the adsorption due to oxycellulose, which often contains mineral matter introduced during the oxidation in addition to that originally present in the cotton.

Knaggs[61] has used the benzopurpurine test (devised by Knecht[32] to determine whether cotton has been mercerized) to show the presence of oxycellulose. The material under examination is washed with dilute hydrochloric acid and with water and dyed a deep shade with benzopurpurine. On further treatment with acid, the shade becomes blue, and, on rinsing in water so that the red color on the unattacked cotton reappears, the oxycellulose remains blue-black in color.

Scholl[63] has proposed a test with a vat dye. The sample is warmed for a few seconds in a flavanthrene "vat" obtained by boiling 0.03 gram of flavanthrene with dilute sodium hydroxide and solid sodium hyposulphite (hydrosulphite), washed, and exposed to the air or treated with hypochlorite to develop the color, and the yellow product is finally boiled with 2*N*-sodium hydroxide, when the color is again reduced to blue at a rate proportional to the reducing power of the modified cellulose. Oxycellulose becomes blue immediately. Ermen[64] has adopted the following modification of Scholl's method: A few drops of a suspension of indanthrene yellow are added to a 10 per cent solution of sodium hydroxide and the cloth to be tested is passed through the mixture, lightly squeezed, and held in steam. Within a minute, a deep blue stain appears where oxycellulose or hydrocellulose has been formed. The rest of the cloth, if it has been properly bleached, shows no trace of blue for at least five minutes. If the cotton is washed, scoured and rubbed with soap, it is found that where reduction has taken place the dye is firmly fixed.

Everest and Hall[65] state that although cotton fabrics are normally unaffected by immersion in a solution of tetrazotized benzidine which has been made alkaline by means of sodium carbonate, a yellowish brown color, which is fast to washing, is developed if oxycellulose is present.

Saget[66] has suggested resistance to coloration by tetrazoic dyes as a test for oxycellulose.

(D) Adsorption of Vanadium

Witz[67] observed that oxycellulose exerted an attraction for a number of inorganic salts, in particular those of vanadium, which were withdrawn from aqueous solutions containing less than one part in a million. He demonstrated the adsorption by printing the tissue with an aniline black mixture.

(E) Color Reactions

The production of a yellow color on boiling with dilute sodium hydroxide is usually considered to be characteristic of both oxycellulose and hydrocellulose. The former alone is stated to give the color on steaming.[72]

Jandrier[68] has recorded the following color reactions which he considered particularly characteristic of oxycellulose prepared by the action of potassium chlorate: To a few centigrams of one of the reagents mentioned below are added 1 or 2 cc. of a solution or suspension of oxycellulose, followed by 10 cc. of sulphuric acid, free from nitrous acid, carefully poured down the side of the tube. At the junction of the liquids colorations are formed in

the cold or on warming. Phenol gave a golden yellow color; alpha naphthol, violet; beta naphthol, or quinol, brown; resorcinol, yellow-brown; menthol or thymol, rose tints, gallic acid, green turning to violet in the sulphuric acid, and morphine or codeine, rich violet.

Berl and Klaye[21] tested the products obtained by the use of a number of oxidizing agents, and have recorded in all cases a blue coloration with iodine and zinc chloride. With iodine and sulphuric acid a blue color resulted except when the oxidizing agent was calcium permanganate (light brown), nitric acid (yellowish) and potassium chlorate (yellowish brown). Bumcke and Wolffenstein[38] record that "acid cellulose" gives no coloration with the iodine reagents.

Oxycellulose is stated to give rise to a violet dye, soluble in ether, when boiled with beta naphthoresorcinol and hydrochloric acid.[85] The product to be tested (0.2 gram) is boiled for one minute with 2 cc. of a 1 per cent solution of beta naphthoresorcinol and 2 cc. of concentrated hydrochloric acid, with vigorous shaking, then cooled and extracted with ether, when the ether develops a reddish violet to violet color.

Most oxycellulose preparations restore the color of Schiff's reagent.

Schwalbe and Becker[50] have found that when a few drops of methyl orange are added to a suspension of a strongly acid oxycellulose in water, an orange-red results. The addition of a few cubic centimeters of a concentrated solution of sodium chloride changes the color to red with oxycelluloses generally (see Table I). Hydrocelluloses, on the other hand, fail to give the coloration, so the test has been suggested as a means of differentiation.

(F) Production of Furfuraldehyde

It is generally considered to be characteristic of oxycellulose that a larger proportion of furfuraldehyde is formed on distillation with hydrochloric acid (*d.* 1.06) than is obtained from cellulose. The furfuraldehyde is generally estimated as the phloroglucide, the results being calculated from the tables given by Krober.[63] Cross, Bevan and Beadle[15] appear to have been the first to study the reaction. The figures given in the following table show the variation which has been observed.

Observer	Oxidant	Yield Furfuraldehyde (per cent)
Vignon[14]	$KClO_3$ and HCl	2.1
Zanotti[70]	$KClO_3$ and HCl	0.8
Cross, Bevan & Beadle[15]	CrO_3 and H_2SO_4	4.1; 6.3; 8.2
Vignon[14]	CrO_3 and H_2SO_4	3.0; 3.1; 3.5
Zanotti[70]	CrO_3 and H_2SO_4	3.0
Zanotti[70]	$KMnO_4$ and H_2SO_4	1.9
Nastukoff[18]	Bleaching powder	1.1
Haas & Tollens[39]	Nitric acid	2.6
Faber & Tollens[7]	Nitric acid	2.3
Oertel[46]	Electrolysis in KCl	1.7
Faber & Tollens[7]	Bromine and $CaCO_3$	1.4; 1.5
Cunningham & Dorée[27]	Ozone	1.1; 1.5

Although Schwalbe and Becker[50] state that the production of furfuraldehyde cannot be considered as a characteristic property of oxycellulose, and Lenze, Pleus, and Muller[87] have suggested that methylfurfuraldehyde is formed, the work of Heuser and Stockigt[85] would appear to confirm the earlier view. While the phloroglucide of furfuraldehyde is insoluble in alcohol, those of methylfurfuraldehyde and hydroxymethylfurfuraldehyde dissolve on warming.[88] The proportion of phloroglucide soluble in alcohol obtained by Heuser and Stockigt was large in the case of hydrocellulose, lower in the case of cellulose, and much lower in that of oxycellulose, the color reactions with resorcinol, diphenylamine, and beta naphthol indicating that the soluble portion was derived from hydroxymethylfurfuraldehyde and not methylfurfuraldehyde. The identity of furfuraldehyde was proved by conversion into the phenylhydrazone.

(G) Action of Heat

Philip[71] has stated that after hot calendering, yellowish to brownish stains appear when oxycellulose is present. These fade to yellow on standing.

(H) Nitric Esters of Oxycellulose

Cross and Bevan[6] prepared the mononitrate of an oxycellulose obtained by the action of nitric acid, while from a similar source Bull[9] isolated a product (N = 11.6 to 11.9 per cent) the empirical formula of which approximated to that of a dinitrate. Berl and Klaye[21] have compared the nitrates obtained from a number of representative oxycelluloses by means of a nitrating acid containing 46.2 per cent of sulphuric acid, 42 per cent of nitric acid, 0.25 per cent of nitric oxide, and 11.5 per cent of water. The proportion of acid to oxycellulose was 50 to 1 and the reaction was allowed to proceed for twenty-four hours at 19 to 20 deg. Cent. in each case. The products differed but little in empirical composition from a cellulose nitrate prepared under the same conditions. Their results are incorporated in the following table:

Substance Nitrated	Nitrogen: Nitrometer	Nitrogen: Dumas	Solubility in Ether-Alcohol	Fixation of Methylene Blue	Relative Viscosity
Cellulose	13.5 per cent	13.3 per cent	1.8	0.6 mgr. per gram.	10,000
"Hydralcellulose"	13.2 per cent	13.4 per cent	12.1	2.4 mgr. per gram.	65.7
Oxycellulose ($KMnO_4$)	13.3 per cent	.....	18.0	1.6 mgr. per gram.	5.15
Oxycellulose (Br)	12.9 per cent	13.3 per cent	15.5	3.5 mgr. per gram.	9.1
Oxycellulose ($Ca(MnO_4)_2$)	13.25 per cent	.....	20.5	3.3 mgr. per gram.	11.1
Oxycellulose (HNO_3)	12.9 per cent	13.3 per cent	34.0	5.0 mgr. per gram.	7.9
Oxycellulose ($KClO_3$)	13.0 per cent	.....	18.0	3.0 mgr. per gram.	7.2

Bumcke and Wolffenstein[88] have compared the action of nitric acid (d 1.48) on cellulose, "hydralcellulose" and "acid cellulose lactone." The following table gives their results, the products in each case being separated into portions soluble in alcohol and acetone respectively:

Nitration of—	Nitrogen Content of Portion Soluble in Alcohol	Nitrogen Content of Portion Soluble in Acetone	Explosion Point of Portion Soluble in Alcohol	Rotation of Portion Soluble in Alcohol, in Acetate Solution — Conc.	Rotation of Portion Soluble in Alcohol, in Acetate Solution — Obs. Rot.
Hydralcellulose	8.8 to 8.9 per cent	8.2 per cent	187 to 189° C.	18.3 per cent	1° 18′
Acid cellulose lactone (from Schweitzer's reagent)	.....	8.2 per cent	188 to 191° C.	22.6 per cent	1° 35′
				8.8 per cent	0° 30′
Acid cellulose lactone (from boiling NaOH)	8.1 to 8.3 per cent	7.8 per cent	184° C.	17.81 per cent	1° 19′
				17.78 per cent	1° 8′
Cellulose	8.6 per cent	7.9 per cent	191 to 193 C.	20.3 per cent	1° 25′

Vignon[78] compared the nitrates obtained under the same proportion of nitrogen, though they differed in their behavior towards Fehling's solution, potassium hydroxide ($d = 1.3$) and in the amount of furfuraldehyde isolated on distillation with acids. He concluded that the conversion of cellulose into its oxy and hydro derivatives was without profound effect on the molecular structure.

Piest[74] has ascribed certain abnormalities noticed in the viscosity of nitrocellulose to the presence of the esters of beta oxycellulose.

(J) Action of Acetic Anhydride

The action of acetic anhydride and sulphuric acid on a number of preparations of oxycellulose has been examined by von Hardt-Stremayr[75] who used the technique described by Skraup and Konig,[76] and isolated alpha octoacetylcellobiose in amount varying with the oxidizing agent previously employed.

	Yield of Octoacetylcellobiose
Cellulose	25 per cent
"Hydralcellulose"	25 per cent
Oxycellulose ($KClO_3$ and HCl)	10 per cent
Oxycellulose (HNO_3)	16 per cent

He concluded that oxycellulose contained a smaller number of cellobiose groups than cellulose. By the action of acetic anhydride in the presence of zinc chloride, Vignon and Gerin[77] obtained an acetate which resembled that isolated from cellulose under similar conditions, but retained strong reducing properties. It is described as a tetra-acetate. Oertel[46] who used an oxycellulose prepared electrolytically, and treated it in a similar manner, observed that oxycellulose was more readily esterified than cellulose and that the product dissolved more completely in acetone, the laevorotatory power of the solution being relatively lower. While the acetates prepared from cellulose contained about 62.5 per cent of combined acetic acid, those from oxycellulose contained 59 to 60 per cent. Acetoylsis by Ost's method[78] yielded 30 to 31 per cent of crystalline cellobiose acetate, whereas comparative experiments with cellulose gave 40 per cent. Franchimont[79] also examined the action of acetic anhydride in the presence of zinc chloride, but does not appear to have identified the product of the reaction.

(K) Appearance of the Oxidized Fiber

According to Vetillart[80] microscopic examination shows that oxidation is accompanied by diminution in the length and width of the fiber. Permetier[81] states that the oxidized fiber does not swell like ordinary cotton when brought into contact with "cuprammonium."

(L) Acid Hydrolysis

Vignon[59] compared the relative copper reduction of the soluble products obtained by treating a number of celluloses, oxycelluloses and hydrocelluloses with dilute hydrochloric acid at 100 deg. Cent. for six hours. The figures obtained in the cases of oxy and hydro cellulose were high compared with those obtained with cellulose. Schwalbe[86] has attempted to place the reaction on a quantitative basis for purposes of comparison.

(M) Alkaline Hydrolysis

The alkaline hydrolysis of oxycellulose has been studied by Tollens and his collaborators,[7 51] who treated the material obtained by the action of potassium chlorate and hydrochloric acid on cellulose with boiling milk of lime and isolated *iso*saccharic acid and dihydroxybutyric acid from among the soluble products of the reaction.

(N) Adsorption of Formaldehyde

Beltzer[82] states that oxycellulose absorbs large quantities of formaldehyde and yields a very tough product.

(O) Adsorption of Moisture

Although it is generally stated that the normal moisture content of oxycellulose is lower than that of cellulose, no trustworthy figures have been published. Isolated figures are given by Will[88] and by Heuser and Stockigt[83] whose figures for a number of preparations dried in the air show a variation of from 2.6 to 8.4 per cent.

(*Bibliography on page following.*)

BIBLIOGRAPHY

[1] Bull. Soc. Rouen, 1883, **10,** 416; 1884, **11,** 169; compare H. Schmidt, Dingl. Poly. J., 1883, **250,** 271.

[2] J. Soc. Chem. Ind., 1884, **3,** 206, 291.

[3] U. S. Pat. 1212158; see also 1, 17, 18, 29, 30.

[4] Compare Beltzer, Rev. Gen. Mat. Col., 1902, **6,** 35; P. de Micheli, Z. Farben u. Textile Chemie, 1903, **2,** 437; Chaplet et Rousset, "La Mercerisage et les Machines à merceriser (1909), p. 44.

[5] Compare Witz, E. Pat. 5914 of 1882; P. Lukinoff, Dingl. Poly. J., **259,** 97; A. Scheurer, Bull. Soc. Ind. Mulhouse, 1891, **61,** 484; Brandt, ibid, 496; J. Mullerus, Lehne's Färber Ztg. 1891-2, 127; Scheurer, ibid, 355; C. Kurz, Z. Farben u. Textil Chemie, 1902, **2,** 46; Bleachers' Assoc. and A. A. Benjamin and R. Hübner, E. Pat. 17653 of 1902; Jentsch, Färber Ztg., 1913, **24,** 29; Forsdale, Color Trade J., 1919, **4,** 77.

[6] C. F. Cross and E. J. Bevan, J. Chem. Soc., 1883, **43,** 22; ibid, 1890, **57,** 196; compare Häussermann, Z. angew. Chem., 1910, **23,** 1151.

[7] O. von Faber and B. Tollens, Ber., 1899, **32,** 2589.

[8] Cross and Bevan, "Cellulose," p. 62.

[9] B. S. Bull, J. Chem. Soc., 1897, **71,** 1090.

[10] J. Phys. Chem., 1915, **19,** 159.

[11] W. S. Denham and H. Woodhouse, J. Chem. Soc., 1913, **103,** 1735; 1914, **105,** 2357; 1917, **111,** 244.

[12] Zeitschr. Elektrochem, 1920, **26,** 232.

[13] J. Ind. Eng. Chem., 1921, **13,** 256, 334.

[14] Compt. Rend., 1897, **125,** 448; 1898, **126,** 1355; Bull. Soc. Chim., 1898, **19,** 790; Compt. Rend., 1900, **131,** 558; 1903, **136,** 898, 969.

[15] Ber., 1893, **26,** 2527.

[16] Compt. Rend., 1899, **128,** 1038.

[17] F. P. Jecusco, J. Soc. Dyers, 1917, **33,** 34.

[18] Bull. Soc. Ind. Mulhouse, 1892, **62,** 493; compare A. Scheurer and E. Nolting, ibid, 492-3; Ber., 1900, **33,** 2237; see also H. Moore, J. Soc. Dyers, 1915, **31,** 180; Thies, Färber Ztg., 1913, **24,** 525.

[19] Ber., 1900, **33,** 2237.

[20] J. Soc. Dyers, 1920, **36,** 251.

[21] Zeitschr. Schiess u. Sprengstoffe, 1907, **2,** 381.

[22] Ber., 1902, **35,** 1252.

[23] Zeitschr. f. Farben u. Textilchemie, 1902, **1,** 46.

[24] Ber., 1901, **34,** 719.

[25] Chem. Zeit., 1907, **31,** 833, 844, 857.

[26] Z. angew. Chem., 1906, **19,** 2101.

[27] J. Chem. Soc., 1912, **101,** 497.

[28] Compt. Rend., 1891, **112,** 1374.

[29] C. O. Weber, J. Soc. Chem. Ind., 1893, **12,** 118.

[30] Witz, Bull. Soc. Ind. Rouen, 1883, **11,** 228; Thies and Herzig, D.R.-P. 59674; Schwartz, Bull. Soc. Ind. Mulhouse, 1858, **28,** 375; Prud'homme, ibid, 1891, **61,** 508; Nastukoff, J. Russ. Phys. Chem. Soc., 1892, **24,** 256.

[31] R. Wolffenstein, D.R.-P. 206556.

[32] E. Knecht, J. Soc. Dyers, 1897, **12,** 109.

[33] Ber., 1899, **32,** 2493; 1901, **34,** 2415.

[34] Centr. f. Physiol., vol. **1,** 33.

[35] Bull. Soc. Ind. Mulhouse, 1868, **38,** 914.

[36] C. Dorée and M. Cunningham, J. Chem. Soc., 1913, **103,** 677.

[37] J. Chem. Soc., 1913, **103,** 1347.

[38] J. pr. Chem., 1846, **39,** 150.

[39] R. W. Tromp de Haas and B. Tollens, Annalen, 1895, **286,** 296.

[40] J. B. Lindsey and B. Tollens, Annalen, 1892, **267,** 366.

[41] E. R. Flint and B. Tollens, Annalen, 1892, **272,** 288.

[42] Ber., 1901, **34,** 3589.

[43] Z. angew. Chem., 1912, **25,** 2518.

[44] Compt. Rend., 1903, **136,** 818.

[45] Ber., 1904, **37,** 549.

[46] Z. angew. Chem., 1913, **26,** 246; Diss., Hanover, 1912.

[47] J. Soc. Dyers, 1917, **33,** 17.

[48] J. Soc. Dyers, 1920, **36,** 195.

[49] J. Soc. Dyers, 1898, **14,** 6.

[50] Ber., 1921, **54,** 545; Zellstoff u. Papier, 1921, **1,** 4, 100, 135; Z. angew. Chem., 1918, **31,** 50.

[51] Ber., 1901, **34,** 1427; see also Schwalbe and Becker, J. prakt. Chem., 1919, **100,** 19.

[52] Compt. Rend., 1899, **128,** 1038.

[53] J. Soc. Dyers, 1910, **26,** 273.

[54] Ber., 1907, **40,** 1347, 4523.

[55] J. Soc. Dyers, 1913, **29,** 205.

[56] J. Soc. Dyers, 1920, **36,** 255.

[57] J. Soc. Dyers, 1912, **28,** 359.

[58] Kunstoffe, 1914, **4,** 266.

[59] Vignon, Bull. Soc. Chim., 1901 (iii), **25,** 130.

[60] Kita, J. Chem. Ind. Tokyo, 1917, **20,** 138, 219.

[61] Knaggs, J. Soc. Dyers, 1908, **24,** 112.

[62] J. Soc. Dyers, 1908, **24,** 67, 68.

[63] Ber., 1907, **40,** 1692; 1911, **44,** 1312.

[64] J. Soc. Dyers, 1912, **28,** 132.

[65] J. Soc. Dyers, 1921, **37,** 227.

[66] Mon. Sci., 1892, 640.

[67] Bull. Soc. Chem., 1886, **45,** 309.

[68] Compt. Rend., 1899, **128,** 1407.

[69] J. Landw., 1901, **48,** 357.

[70] Ann. Soc. Chem., Milano, 1899, 27.

[71] Z. offentl. Chem., 1901, **6,** 124.

[72] Freiberger, Färber Zeit., 1917, **28,** 221, 235, 249.

[73] Compt. Rend., 1898, **126,** 1658; 1899, **127,** 872.

[74] Z. angew. Chem., 1913, **26,** 24.

[75] Monatsh., 1907, **28,** 63, 73; see also L. Landsberg, E. Pat. 4886 of 1902.

[76] Monatsh., 1901, **22,** 1011.

[77] Compt. Rend., 1900, **131,** 588.

[78] Verh. ges. deut. Naturforsch. Aerzte, 1913, 124; Annalen, 1913, **398,** 313.

[79] Rec. Trav. Chim., 1883, **2,** 241.

[80] Bull. Soc. Ind. Rouen, 1883, **11,** 234.

[81] Bull. Soc. Ind. Rouen, 1883, **11,** 236.

[82] Eighth Intern. Congr. Appl. Chem., orig. comm., 1912, **7,** 7-21.

[83] "Mittheilungen," Neu Babelsberg, 1904; reviewed, Cross and Bevan, "Researches," 1900-1905 (vol. ii), p. 77.

[84] Papierfabrikant, 1919, **17,** 301.

[85] Cellulosechemie, 1922, **3,** 61.

[86] Chemie der Cellulose (1918), 635.

[87] J. pr. Chem., 1920, **101,** 259.

[88] Testoni, Staz. sperim. agrar. ital., 1917, **50,** 97.

[89] J. Soc. Dyers, 1922, **38,** 132.

[90] Biochem. Z., 1920, **103,** 19.

USE OF TITANIUM IN DYEING AND MORDANTING

In serial No. 2406 of the Reports of Investigations of the U. S. Bureau of Mines, Robert J. Anderson, the investigator, has the following to say concerning the uses of this metal in dyeing and mordanting, coloring porcelain, and in pigments:

For use in the dyeing industry, titanium was exploited first in England by Barnes. In general the "ous" salts are powerful mordants which produce brilliant and stable colors. The salts used commercially are the sulphate, chlorides, fluoride, oxalate, tartrate, lactate, and the double alkali derivitates of these salts. The titanium compounds that have been successfully used in this connection find application as mordants and dyes for wool, cotton, mixed goods, and for paper. Titanium-potassium oxalate ($TiOC_2O_4$, $K_2C_2O_4$, H_2O), titanium-sodium sulphate ($Ti_2(SO_4)_3$, Na_2SO_4, $5H_2O$), titanous chloride ($TiCl_3$), titanous sulphate ($Ti_2(SO_4)_3$), titanous sulphocyanide ($Ti(CNS)_3$), and others, have found extensive application. Salts of titanium have been used also in dyeing shoe leather, and do not embrittle the leather as with salts of iron.

Rutile (titanium dioxide) is employed for coloring glazes for pottery and enamels, both in chemical combi-

nation and as a mechanical mixture. The shade of color depends upon the amount used. On account of its relative cheapness, rutile has supplanted uranium compounds, which are too expensive for commercial employment. A little rutile has been used in making glass. The mineral also finds application in making artificial teeth, to produce the color required for matching; the content in the paste from which the teeth are molded varies from 0.5 to 5 per cent. The Foote Mineral Company, Philadelphia, Pa., makes dental enamels from titanium compounds.

During the past seven years the use of titanium for pigments has developed rapidly, and this is probably one of the most important future uses of titanium. Titanium white—that is, titanium dioxide—appears to be very promising for pigments, since it is non-poisonous and has large covering capacity. It is used principally in admixture with barium sulphate, yielding a product similar to lithopone. One commercial product has the same specific gravity (4.28) as lithopone of a well-known brand; it contains 25 per cent titanium dioxide and 75 per cent barium sulphate. The manufacture of titanium white has been developed abroad in Norway.

Multi-Color Effects in Simple Piece Dyeing

(Concluded)

The Simplest Method—Loose Material—Tops—Differences in the Piece—Effect of Caustic Soda—Preparation of Wool—Variations—The Selective Principle—Some Recipes—Heather Mixture Varieties—Crossbreds

By REX CROSS

THEN, there is the operation of drying, which could be made to do double duty. The air to which the wool is subjected may have supplied to it a small percentage of some active gas—sulphur dioxide, hydrochloric acid, chlorine or nitrous fumes This gas-treated wool would take dye quite differently from untreated wool.

Cheap Methods

These two methods—the varying of the scouring bath and the gaseous treatment during drying—would be very cheap indeed, and would in nowise interfere with the mechanical progress of the raw material toward the loom. The working up of the treated material would be a matter for the designer. It could be mixed while loose with normal stock and would result finally in a kind of heather mixture when piece-dyed, or it could be spun to itself and woven into stripes or checks. The dyeing process in the piece would be normal in most cases.

Here we may mention an advantage of procedure of this kind. We have already said that an obvious question was, "Why not dye part of the material?" We have seen patterns where part of the material *had* been dyed. The pieces had been made with a thread of dark neutral gray about every quarter of an inch. They came from the loom, therefore, white with a dark fine stripe. The white was dyed various colors and the final results were colored cloths with black pin stripes. The dark gray threads had, of course, taken some dye during the piece dyeing and had darkened into black. They had originally been dyed with some after-chrome black which was fast to acid dyeing.

Advantages

The advantages of this method of manufacture are several. In the first place, a great many pieces can be woven all alike, getting thereby the advantage of large lots over small. Only about one-tenth of the fabric is dyed previous to looming—with all the gain which that implies. The large stock of woven goods is dyed as customers' requirements come along. The varying fancies of the market are met much more promptly than under ordinary circumstances. The usual procedure is to receive the orders, dye loose stock or yarn or warp, and weave. In the case of loose stock it has to be spun. In the last two cases rewinding or warp dressing and weaving are necessary. The difference in time may be a matter of weeks. For purely commercial reasons, therefore, it pays to *dye* a portion of the material woven into the cloth. The various pretreatment methods we have suggested would be cheaper still.

Finally, it is possible to get heather mixture by piece dyeing goods which have had no special treatment, though the fact is not generally known. It is done by deliberately exaggerating what is usually considered a fault.

The dyer, as a rule, tries to get his shades solid. What often happens, and what the dyer tries to guard against, is a certain skittery appearance. One way of

expressing it is to say that the fibers are not well covered. The dye makers like to be able to describe their dyes as having good covering power.

The Factors

Several factors go to the making of a skittery appearance. The dyeing process may be at fault. Boiling may not be thorough enough, assistants may not have been added either of suitable kind or in suitable proportions, or in other ways something has been neglected. But the ultimate reason is that the fibers have inequalities in their dyeing properties.

Not only do the fibers differ from one another, but a single fiber may differ in different portions of its length. This is easily understandable when one considers the origin of the fibers. On the sheep's back a fiber of a few inches long is cozily embedded in the depths of the fleece at its root end, but the other is exposed to the weather and the sun and much wear and tear. At the root end it is thickly impregnated with the emollient grease. At the loose end the grease is largely rubbed away from it, especially at the surface. The epidermal scales may be badly worn, but in this respect will vary in different parts of the fleece.

Anyone who has tried to dye a sheepskin a light shade will know how difficult it is to dye level. Apart from the difference between the root ends and the tips, which may be largely due to the dye not penetrating to the roots, the skin when spread out on the floor, when practically only the tips of the fibers are seen, shows much difference in appearance in different parts. A little experience of this kind will prevent surprise at the frequent appearance of skitteriness in dyeing wool goods. Coarser wools are more liable to this phenomenon than the finer qualities. But in varying degrees all wools can display it.

En passant, we would remark that the selective or discriminating absorption of color is very beautifully and distinctly shown in the staining of objects for the microscope. A small piece of tissue—animal tissue, not woven tissue—may in its natural state be an absolutely uninteresting object when magnified. But the microscopist will steep it in a solution of dye. Certain cells may also take the color and reveal themselves. A steeping in another dye may bring into prominence another set of cells.

The scientific usefulness of this will be realized; but, what is more to our present point, these hitherto uninteresting objects are turned into works of art. We may add that the use of chemicals like salvarsan is an exceedingly important development of this selective and discriminating staining. Dyes were found which stain disease germs, but not the blood corpuscles. The dyes were slightly modified molecularly by poisonous radicles, and luckily for us the selective power was little altered, so the dye went to the germ and took the arsenic, etc., with it.

The Selective Principle

The selective principle will also give a working theory of a practical principle known to some dyers, which ought to be known more generally. For a certain shade two dyes may be used time after time with success. There it may be found that some lots will not dye solid. A good thing to try is to employ more than two dyes—say, four. Why should this act, as it undoubtedly often does?

Suppose the two dyes are a yellow and a blue. We can imagine that in the lots which are turning up skittery the tips and the roots of the fibers are not absorbing the dyes alike. The tips may take more yellow than the roots. The roots may take more blue than the tips. Why this is so may be obscure; perhaps the life history of the sheep from which the wool has come would explain something. But if the fact is as stated, the goods will really be a mixture of yellow greens and bluish greens, and will appear to the eye as skittery.

But now suppose another yellow dye may go to the roots rather than the tips. Another blue dye may also behave oppositely to the one that has been hitherto used. Dye the goods with all four dyes and evidently there will not be as much difference between the roots and the tips as with just two dyes. On the law of chances and averages the additional dyes ought to mend matters.

Normal dyeing processes aim consciously or unconsciously at overcoming the selective properties of the fiber or the dye. By deliberately working in the other direction it is possible to intensify the selective effect so that a fabric has the appearance of having been made from material of different colors.

It is usual to get compound shades by mixtures of dyes of one class. A class of dyes is composed of those having a strong family likeness, especially in regard to dyeing properties, and because their affinities for the fiber are similar they are the most suitable for working with each other when getting compound shades. To get skittery effects it is necessary to go out of the ordinary methods.

Instead of choosing those dyes which dye most level, an opposite principle is adopted; or in the case of dyes which can be applied in more than one way, the *unusual* method is adopted; or in the case of mixing dyes, not those of good compatibility but those of less compatibility will be chosen.

For instance, among the basics the Nigrosines give very skittery results. The direct cotton colors range from those which are practically acid dyes for wool to those which in union goods prefer the cotton and leave the wool nearly white. The wool dyer normally uses the former, but for the purpose of our present object those a little farther removed will be chosen. Some of the direct browns give skittery results on wool and have good fastness to light.

The after-chrome dyes get their name from the

method most suitable for them. If they are applied to already mordanted wool they are apt to be very "mixtury." Ordinary acid dyes, and the direct cotton colors also, refuse, as a rule, to dye solid shades on chromed wool.

Some Recipes

A general governing principle is to combine dyes whose shades are as near complementary as possible. A few examples will give some idea of the dye baths to use:

(1)—Coomassie Navy Blue RN..... ½%
Chrysophenine ..... ½%
Salt 10%
Acetic acid (40%) 1%
(or ½% sulphuric acid)

(2)—Alizarine Cyanine Green powder..... 1%
Rhodamine ..... ½%
Glauber salt 10%
Acetic acid 1%
(or ½% sulphuric acid)

(3)—Disulphine Blue ..... ½%
Chlorazol Brown ..... ½%
Salt 10%
Acetic acid 2%
(or ½% sulphuric acid)

(4)—Chrome with 3 per cent chrome without assistant. Dye with—
Fustic extract 3%
Disulphine Blue ..... ¾%
Acetic acid ..... ½%
D. O. V..... ¼%

(5) Chrome as (4). Dye with—
Solochrome Black T (or Era Dark Blue B) 3%
Fustic extract 3%
Acetic acid ..... ½%

(6)—As (5), but with ¼% Rhodamine in addition.

Heather Mixture Varieties

Although these dyeings give imitations of heather mixtures when the wool has been dyed either loose or in the form of stubbing, there is a difference. Take the first recipe. If a blue and a yellow had been dyed separately with Coomassie Navy Blue and Chrysophenine, respectively, and the loose wool mixed, it would have been a distinct mixture of two shades. But the result from recipe (1) is not so clear cut. Not many fibers or portions of fibers are a pure Coomassie Blue shade or a pure Chrysophenine shade. But all gradations are found between a dulled blue and a dulled yellow. Although the effect would be classified as of the heather-mixture order, yet there is a novelty about it.

Recipe (2) emphasized this point to us because of something which happened years ago. Most dyers will have had experience of customers who have come to them with ideas of new colors and effects. They have found a plant with a leaf or a flower of a shade they have never seen before. Or they have come back from the seaside with a pebble or two. Or they have found a vase or a piece of jewelry—and so on.

The particular instance we were reminded of by the dyeing from recipe (2) was that of a manufacturer who had been struck by the play of color on the neck feathers of pigeons. He would wax eloquent over this color effect. By mixing bluish green wool with some reddish violet, an imitation of it was got. But, as the dyer was often told, nature still left art far behind. The reason was that the feathers shaded off from one tint to another by infinite gradations. To get these in the usual way was, to borrow a phrase from another sphere, outside practical politics. But recipe (2) does it beautifully. But, alas! there is always a fly in the dyer's ointment; that manufacturer is dead, and we have not been able to put before him this latest attempt at his ideal.

Crossbreds

Although these mixtury effects can be got to a certain extent on practically any cloth, they are better on crossbreds than on botany. By making blends from wools of obviously different tints the effect could be improved. "White" wools show noticeably different shades of white. Really they are mostly tints of yellow. What is often referred to in the trade as "natural" wool is a mixture of brown and white. This, of course, is an excellent basis for getting slubbing dyeing effects from piece dyeing, and equally, of course, for getting slubbing-dyed-goods prices for the cloth which has been really piece dyed. Still closer imitations could be got if the loose stock were treated as mentioned earlier (chloring, etc.).

The chief practical difficulty is that exact repeats could not be guaranteed. As a set-off to this, every lot would be finished first "show up." Under the very nature of the case, these small lots could not be entered time and time again in order to get one shade. After all, this is the chief bugbear of small lots. They take, individually, more bothering with to get a shade than large lots, and it is this which so unduly adds to their cost. Small lots, free from this handicap, would be turned out very quickly. Every one would be a different pattern, and the multiplicity of patterns would not be the source of expense it is with ordinary wool but would have the advantage of offering a larger choice to the customers. The idea seems worth trying.—Dyer and Calico Printer.

WHITE AND FAST COLORED DISCHARGES

A process patented by the Calico Printers' Association and George Nelson, M.Sc., (185,007) consists in printing mordanted and dyed cotton with discharge pastes comprising caustic alkali, with or without sulphoxylates and glycerine, for white discharge effects and together with vat colors for colored discharges, the fabric being then subjected to the usual operations.

Mordants and Dyestuffs.—(a) Dye chrome mordanted fabric with tannin in one operation, and then with the dyestuff in a second operation, or dye chrome mordanted fabric with the dyestuffs in one operation, and then with the tannin in a second operation, or dye chrome mordanted fabric with tannin and dyestuffs simultaneously in one operation with the addition of the usual assistants such as acetic acid.

(b) Pad chrome mordanted fabric with a tannin solution, dry and steam or age. By this method, the dyestuffs may be applied either before or after the tannin.

(c) Mordant the fabric by impregnating with a solution comprising a suitable chromium salt and tannin, with the addition of a suitable solvent such as acetic acid, age, wash and dye with the dyestuffs.

(d) Mordant the fabric with tannin first, then with a suitable chrome mordant, then apply the dyestuffs.

If the cloth has been mordanted and dyed before the tannin takes place, then dyestuffs are used capable of dyeing on the mordant, such as Chrome azurines, Chromophenines and Alizarines. The same dyestuffs with the exception of Alizarines, are employed if the mordanted cloth is dyed in one bath containing both dyestuffs and tannin. If the mordanted cloth is tanned before dyeing, dyestuffs such as Prune and Modern Violet may be employed.

The white discharge pastes may contain sulphoxylates and glycerine as these additions show certain advantages, and both the white and colored discharges may have Rochelle salts added thereto. Many colors are, however, discharged by thickened caustic alkali solution without the additions.

If the mordants and dyestuffs have been applied to the fabric in accordance with (a) and (b), the following discharge colors may be printed on:

White Discharge.—9 lb. British gum solution (prepared from 3 lb. British gum boiled up with 1 gallon of water); 3 lb. caustic soda liquor, 60 deg. Tw.; 3 lb. Rochelle salts. This mixture has a bulk of about 3½ gallons. It is reduced in strength for printing, according to the depth of the engraving with gum solution.

Colored Discharge.—1 gallon vat dye paste 20 per cent; 2½ gallons white discharge; 2½ gallons hydrosulphite gum (prepared from 10 lb. hydrosulphite boiled up with 1 gallon British gum solution, making a total bulk of about 2 gallons); ⅛ gallon soap solution (prepared from 1 lb. soap boiled and dissolved in 1 gallon of water); ⅛ gallon glycerine; 6 lb. Rochelle salts.

If the mordants and dyestuffs have been applied to the fabric in accordance with (c) and (d), then the white discharge can be obtained by the mixing above, but with the Rochelle salts omitted. The colored discharge is then as follows: 1 gallon vat dye 20 per cent paste; 2 gallons caustic soda 60 deg. Tw.; 2½ gallons hydrosulphite gum solution (as before); ½ gallon British gum solution; ⅛ gallon soap solution; ⅛ gallon glycerine.

The advantage of the improved process is that the mordanting and dyeing operations to produce the dyed ground can be done as soon as convenient after one another, and the fabric can then be preserved indefinitely and discharged whenever required.—Dyer and Calico Printer.

JURY AWARDS PRIZES FOR SILK SHOW POSTER DESIGN

After a deliberation of nearly three hours spent in the careful examination of fifty-five sketches submitted in the International Silk Exposition poster contest, the jury has made the following awards:

First prize $50, Mirzah de Kosenko, No. 33 West Sixty-seventh Street, New York; Second prize $25, Leonard Gussow, No. 186 Pulaski Street, Brooklyn; third prize $15, Irma Sompagroc, Natchitoches Art Colony, Natchitoches, La.; fourth prize $10, Flora E. Dexter, No. 243 West Twenty-first Street, New York.

Honorable mention was made of designs by Armin Oswald, No. 353 West Fifty-sixth Street, New York; Andrew Avinoff, Napanoch, N. Y.; Richard Marwede, 976 Anderson Avenue, New York; Ruth Wilson Lester, 562 West End Avenue, New York; Natalie Bliss, Miss Alvine and M. D. Tunstall, Florence Wilde Studios, 63 West Ninth Street, New York.

The members of the jury were Howard Greenley, president of the Architectural League of New York and art director of the International Silk Exposition; Harvey W. Corbett, chairman, Committee on Competitions and Awards, Architectural League; Lee Simonson, stage designer, Theatre Guild, Inc.; J. Scott Williams, etcher and painter; Emil Fuchs, painter and sculptor.

The fifty-five sketches presented a wide range of symbolistic design and brilliant color, and the four prize winners were very different in both subject and technique. The first represented a colorful square of silk in the conventionalized design of a leaping deer, against a background of black with vivid green lettering. The second pictured a Japanese silk reeler in black silhouette against an orange background. The third, especially commended for its idea, was a silk comet, the head formed of two cocoons and the brilliant streamer a flash of patterned silk. The fourth prize was given to a Chinese subject, somewhat too detailed in drawing, in the opinion of the jury, but very good in its suggestion of the quality of "silkiness."

"The purpose of the contest," said Mr. Greenley, "was not to secure a finished poster for the Exposition, but only to obtain suggestive sketches from which a poster design may be evolved. The results have been most valuable."

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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BOTH ARE NEEDED

FOR some time we have been awaiting a favorable opportunity for the presentation of the following Saturday Evening Post editorial, which we have secured permission to reproduce. It represents some thoughts of the editor of that publication, George Horace Lorimer, which are not inapplicable to the whole question of technically trained executives for the American dye industry.

In a certain sense, it does not add anything to what has been set forth here many times. If the writer does not go so far as to state the fairly obvious fact that a born "handler of men" without technical training would be an unsatisfactory candidate for an executive position in the dye industry, he at least recognizes the fact that your chemist cannot hope to qualify as an executive without a native talent for leadership.

One could wish that Mr. Lorimer had gone further and emphasized the fact that in many cases men of the professional class, be they chemists, lawyers or what not, constitute the only logical field in which to seek for executives. He apparently understands well enough that this is true; but it is not likely to be quite so obvious to most of his readers. As it is, he does nothing to correct the still popular fallacy that the hard-headed "plain business man," with his common "horse sense" and copy-book maxims, will usually "get there." And, as a matter of fact, he usually will—but *not* as head of a coal-tar dye manufacturing enterprise.

The men whom Mr. Lorimer regards as the "adjuncts of business"—namely, the bankers, lawyers, etc.—are, sure enough, professional men, and it is from among them that the present executives for the American dye industry were largely drawn. The mystery is in why the proper profession, chemistry, was not canvassed when these leaders were picked. It may be that it was because among "business men" there remains the deeply-rooted notion, relic of a very dead past, that chemists do not and cannot know anything of business and business methods. That this is largely rot is attested by many leading lights in the industrial world to-day. The mental endowments necessary to attain the heights in chemistry are at least the equal of those observed in any other profession, and it is inconceivable that these men, as a class, do not also average as high in the qualities necessary to leadership of great industrial enterprises, particularly when those enterprises are concerned with the very subject which gave them their doctors' degrees.

With this comment, we will let Mr. Lorimer expound and clarify under the general title "No Substitute":

With the amazing material development of this country since the Civil War, and more especially perhaps in the last generation, has come a marked increase in the importance of those professions which are in a sense the adjuncts of industry and commerce. Such are the chemists, engineers of many varieties, accountants, statisticians, advertising and publicity men, lawyers, economists, and in a sense banking itself. Each group has grown in numbers and in professional standing.

At a recent convention of one of these groups a member who had become wearied of listening to speeches which made it appear as if this particular profession covered the entire business map went to the secretary at the close of the session and said, "At the next convention I suggest that you have a paper on our profession as a substitute for management."

Sad to relate, the secretary took the suggestion seriously. But there is no substitute for management or for the business man. The manager, the chief executive, the business enterpriser has many faults. Too often he acts upon flimsy and insufficient knowledge. He is poorly trained and his ideals are often deplorable. Instead of being guided by well-defined, scientific and long-headed policies, he frequently acts upon impulses, and looks for his profits in the bargains of the moment instead of well-considered services to the community.

But it is difficult to see how any of the professional groups and cults or all of them could take his place. A short time ago a man in his ripe forties, who had been trained as a lawyer, was made the chief executive of a corporation which is among the four or five largest and most important in the world. The day after his promotion he told one of his assistants to make no appointments for him for some weeks to come which would in any way interfere with the work which he proposed to devote himself to—namely, the taking up of problems of internal organization. Who doubts that his ability to solve those questions, rather than any knowledge of law, will spell success for him?

It was once said that an education has no value ex-

cept as it affords ability to know a good man when one sees one. But such ability is essentially an individual matter and largely independent of education, occupation and profession. In a business of any size the head of the concern must be engaged mostly with personal problems, relieving men of responsibilities, giving it to others, shifting men around, finding new ones, getting rid of a number, and still retaining the spirit of co-operation and good-will. Those who know the most about it say what common observation indicates: that this is a problem the chief executive must face alone.

Now, if a chemist, a cost accountant, a lawyer or any other professional man has this gift of organization and the initiative to do things with an organization when he has once got it, he will soon become a substitute for management in the sense that he will become the management. Until then he will continue to work for a business man. Even the greatest bankers and the money kings in the nation's financial center must depend upon finding executives of great outstanding ability. Vast wealth or financial pre-eminence bows before builders, organizers, developers, men like Hill and Harriman.

An experienced vice-president of a considerable enterprise in one city was called to another city to head an even larger company in the same line, but one in dire straits. A farewell dinner was given him by more than a hundred young men from all parts of the country who called themselves his boys, because they had worked for him at various times. In his speech he said he was confident of making a success of any business, provided he could draw enough of these young men into his organization. Within a year after taking his new position he had thrown the red ink out of the window. This simply means he had the gift of organization, of getting teamwork.

Experience does not show that business enterprises can be successfully conducted without reposing final responsibilities upon one man or at most a very few men. These responsibilities in the last analysis have to do with human and personal problems, the ability to handle which some men are born with and others are not, irrespective of subsequent training and occupation. Improvements in technical and professional training will always prove valuable aids to business, but that is a far cry from being a substitute for the sheer ability which is the vital essence, the indefinable spark of business success and progress.

And we may add, just to keep the balance even, that this "sheer ability which is the vital essence . . . of business success and progress" will always prove a valuable—and even necessary—aid to a dye company, but that is a far cry from technical and professional training.

NOBBE HEADS CAMPBELL IMPORT DEBARTMENT

With the organization of its new Import Department, John Campbell & Co., 75 Hudson Street, New York City, announces that Paul Nobbe has been placed in charge, and that the company is now prepared to render dye users double service as manufacturers and importers.

S. O. C. M. A. CHOOSES WILMOT AS CUSTOMS TECHNICAL ADVISER

The Board of Governors of the Synthetic Organic Chemical Manufacturers Association of the U. S. has elected H. F. Wilmot as technical adviser to the Association in matters involving administration of customs duties under the present tariff act.

Mr. Wilmot was president and a director of the Tinc Tura Laboratories, Brooklyn, N. Y., and has severed his connections with that organization in order to devote his entire time to his new duties with the Association. His office will be Room 1648, Equitable Building, 120 Broadway, New York City.

FERMASOL, NEW DIASTASIC PREPARATION OF ANIMAL ORIGIN

Starch, when acted upon by diastase, is converted by a proctss of hydrolysis into a mixture of soluble compounds such as soluble starch, dextrine and maltose-sugar. This fact is of considerable importance and has been applied to starches used in the manufacture of converting of textiles.

It has long been the practice to treat goods that were too stiff from starch in a malt bath, after which the starch was found to be soluble and easily washed out with warm water. In the earlier days, malt was used. But later there was put on tht market a preparation of vegetable diastase which was more convenient to handle.

Still more recently a new and specially strong diastase of animal origin has been introduced which acts upon starch in the same manner, rendering it soluble. and which, besides the diastasic enzyme, contains other ferments for cleaning the slashed goods. This article is known as Fermasol.

Fermasol is always employed with ordinary (raw) water containing a small quantity of common salt (four to eight ounces per ten gallons bath liquor). Since Fermasol is exceedingly rapid in its action, it is particularly well adapted for use in the bleach house for the purpose of rendering soluble the starch placed upon the warp by the slasher. The removal of this starch is desirable, since it forms a more or less water proof coating, on the warp threads, and this coating prevents the proper penetration of the scouring and bleaching liquors.

Some bleachers remove this starch by a steeping operation, which consists of wetting the goods in warm water and piling in bins for several hours, dur-

ing which time a natural fermentation sets in, and the starch becomes soluble and is easily washed out. The time of steeping can be very much shortened by running the goods in open width through ordinary hot water and then through a dilute solution of Fermasol at about 130 to 135 deg. Fahr. and allowing the goods to lie in a box or bin for approximately fifteen minutes. By the use of a piling machine, the operation can be made continuous drawing from the pile, through a washer, directly into the kier.

Destarching is also advisable at times in connection with the finishing operation where, by mistake or otherwise, the goods have been given too much starch. A simple treatment with Fermasol will render the starch soluble and which then may be washed out, permitting of a refinishing of the goods. At times, it is found that printed goods, when ready for finishing, are very stiff in the blotches as compared with the rest of the piece. If such are finished, they will give an uneven "hand." The stiffness of the blotch is due to the starch of the print color which has not been removed in the soaping or clearing operation, but which will readily yield to treatment in a weak, warm solution of Fermasol and common salt. After washing in warm water and drying these may be finished and will yield a uniform finish.

The pastes used in finishing, and also for print colors, are made up of starches, dextrines, etc., in various proportions. Pastes of similar properties can be made from starch, alone, by using a small amount of Fermasol and common salt, thus eliminating the more expensive dextrine. In this line of work, the amount of Fermasol used, the time and the temperature must be closely controlled in order to guarantee consistent results in succeeding batches.

Potato starch, which is largely used in finishing, is one that pastes at a rather low temperature, and so may be pasted and converted into soluble carbohydrates at the same time by the use of Fermasol. It is only necessary to add the water, starch and the proper amount of Fermasol and common salt and heat to about 150 to 155 deg. Fahr. The action is rapid, and in a short time the desired gummy consistency is obtained, after which the paste is heated rapidly to about 200 deg. Fahr. in order to prevent further action of the Fermasol.

If corn starch is employed, the process is modified somewhat, since corn pastes at a temperature so high as to prevent the action of the Fermasol. It has been found advisable to paste the starch with water and common salt first, then to cool down to about 155 deg. Fahr. before adding the Fermasol, then, after the desired consistency has been obtained, heat up rapidly to 200 to 212 deg. Fahr. in order to check action. For very thick pastes of corn starch (four pounds per gallon) one part of the Fermasol has to be added before pasting up (at 150 deg. Fahr.) and the remaining parts after having cooled down again to 185 deg. Fahr. As said before, by noting the amounts of Fermasol used, the time required to produce the desired consistency and the temperature of reaction, duplicate batches can be produced.

Fascisti Remove Italian Import Duties on Dyes and Intermediates

Many Anticipate Financial and Industrial Improvements by Their Efforts, Declares Sansone—Dye Works Reduce Capital—New Chemical Concerns Organize with Swiss and German Backing —Demand for Colors Improves

By RAFFAELE SANSONE

Genoa, November 8, 1922.
Special to The Reporter.

THE last six weeks were marked by various events which may later have considerable influence on the future of the Italian dyestuff producing industry. Through a decree of October 19 the following modifications per ton were made effective in the customs tariffs:

	Entrance Customs (lire gold)	Coefficient of Majoration (lire gold)
Nitrobenzol	200	10
Raw aniline and toluidine (mixture of isomerides)	200	10
Aniline chlorhydrate	200	10
Unnamed aniline salts	300	10
Unnamed derivatives of aniline	2,500	2
Unnamed naphthalene derivatives	2,000	5
Benzidine	2,000	5
Toluidine, dianisidine, ortho and para toluidine	2,000	5
Xylidine	2,500	2
Phenylene diamine	2,500	2
Phenetedine	2,500	2
Anisidine	2,500	2
Benzidine derivatives	2,500	2
Toluidine and toluidine derivatives	2,500	2
Unnamed dianisidine derivatives	2,500	2

Unnamed xylidine derivatives..	2,500	2
Unnamed phenetidine derivatives	2,500	2
Unnamed anisidine derivatives..	2,500	2
Resorcin	2,500	2
Alpha and beta naphthol.....	2,000	5
Unnamed naphthol and naphthylamine derivatives	2,500	2
Unnamed carbolic acid derivatives	2,000	5
Benzaldehyde and derivatives..	2,500	2
Unnamed benzol, toluol and xylene derivatives	2,000	5

Some color works were compelled by bad business to reduce their capital, this being most particularly the case with the Societa Italiana Colori Artificiali of Milan, which reduced its capital from 5,000,000 lire to 500,000 lire by reducing the nominal value of the shares from 250 lire to 25 lire. While the above was taking place a new firm, the Institute Chimico Subalpino, was founded at Turin for the production of intermediate products, with a capital of 400,000 lire; whereas the S. I. A. Pharmaceutical Products Works, also of Turin, purchased new large works at Stradella for the production of intermediate and complementary products to those already produced for pharmaceutical and technical purposes; and the Sindacato Benzonaftene was founded a Milan for conducting an experimental production of benzo naphthene, which enterprise will be extended in accordance with the industrial success of the venture. Needless to say, at the back of most of these new manufactures are German and Swiss chemists. Some of the intermediates at present used in the Italian synthetic industry are obtained from works in southern Germany.

The above further development of the Italian synthetic chemical industry, which is closely allied with color making, is of great importance, especially when it is considered that during the war the first plant for producing synthetic phosgene was started at Rumianca. Oxide of carbon was employed in this instance, obtained from liquid carbon dioxide, through the use of a special furnace having a high column of coke which was rendered incandescent by the direct passage of the electric current.

A concession of 500 tons of benzol can be obtained in France from the next deliveries this country will receive from Germany on account of war reparation, although in Italy a certain number of benzol-producing concerns were installed during the war. The imports of benzol, toluol and xylol, so important in color making, reached 190 tons during the first three months of this year.

A strong movement, organized by the nationalists in all parts of Italy, succeeded in placing in power the militarists and the liberals; this was accomplished without stopping in any way the activity of the factories, or communications, excepting, for a few hours only, in the case of Rome. There are many now who anticipate marked improvement in the Italian finances through the efforts of the Fascisti, besides the reorganization of all public services and the settling of many questions left unsolved by the preceding ministries—questions that are of vital importance to many industries, such as special inducements to foreign in-

TABLE I

	October 8 to November 8 (lire)	October 8 (dollars)	November 8 (dollars)
Naphthol Yellow	40,000—65,000	1,666—2,708	1,538—2,500
Auramine	60,000—70,000	2,500—2,916	2,307—2,692
Orange II	22,000—25,000	916—1,041	846— 961
Nigrosine, water soluble.....	28,000—35,000	1,166—1,458	1,076—1,345
Nigrosine, soluble in alcohol.....	30,000—38,000	1,250—1,582	1,153—1,461
Sulphur Black	7,000— 9,750	291— 395	269— 375
Acid Black	30,500—34,500	1,260—1,437	1,173—1,326
Direct Black	29,500—35,000	1,260—1,458	1,134—1,345
Chrome Black	34,000—37,000	1,416—1,541	1,307—1,423
Methylene Blue	75,000—90,000	3,125—3,750	2,884—3,461
Direct Blue	24,500—28,000	1,020—1,166	942—1,076
Sulphur Blue	33,500—37,500	1,395—1,562	1,288—1,442
Malachite Green	75,000—90,000	3,125—3,750	2,884—3,461
Acid Green	60,000—70,000	2,500—2,916	2,307—2,692
Direct Green	42,000—54,500	1,750—2,270	1,615—2,096
Bismarck Brown	35,000—41,500	1,458—1,729	1,345—1,596
Magenta (Fuchsine) Crystals.....	70,000—80,000	2,916—3,333	2,692—3,076
Eosine	50,000—75,000	2,083—3,125	1,923—2,884
Ponceaux	28,500—33,500	1,187—1,354	1,096—1,288
Methyl Violet	65,000—80,000	2,708—3,333	2,500—3,076

TABLE II

	October 8		November 8	
	(lire)	(dollars)	(lire)	(dollars)
Acetate of alumina	1,600	66	1,600	61
Chrome alum	3,000	125	3,000	115
Bichromate of potash	5,700	237	5,700	219
Ferrous sulphate	500	20	500	20
Copper sulphate	2,100	87	2,100	80
Tartaric emetic	12,000	500	12,000	461
Aniline oil	10,000	416	10,000	384
White refined glycerine	9,000	375	9,000	346
Glucose, 45 deg. Be	3,900	162	3,900	150
Hydrogen peroxide	2,100	87	2,100	80
Tannic acid, 60 per cent	20,000	832	20,000	769
Tartaric acid crystals	12,000	500	12,000	461
Acetic acid, 30 per cent	2,220	92	2,200	84
Hydrochloric acid, 20-21 deg. Be	300	12	300	11
Formic acid	11,000	458	7,500	288
Lactic acid, 80 per cent	4,000	166	4,000	153
Alum	1,000	41	1,000	38
Ammonia, 22 deg. Be	1,450	60	1,450	55
Bisulphite of soda, 32 deg. Be	380	15	380	14
Chlorate of potash	3,200	133	3,200	123
Chloride of ammonia	4,500	187	4,000	153
Bleaching powder	900	37	900	34
Nitrite of soda	3,000	125	2,950	113
Yellow prussiate of potash	20,000	832	22,000	846
Yellow prussiate of soda	12,000	500	12,000	500
Caustic soda, 70/72	2,000	82	2,100	80
Silicate of soda, 140 deg. Tw	1,000	41	1,000	38
Sodium sulphide	2,200	91	2,800	107
Logwood extract	7,000	291	7,000	269
Yellow dextrine	3,900	162	3,700	142
White dextrine	3,900	162	3,950	151
Farina	3,000	125	2,700	103
Kordofan gum	7,200	300	8,000	307
Indigo, 25 per cent	22,000	916	23,000	884
Beta-naphthol	18,000	750	19,000	730
Industrial castor oil	6,000	250	6,500	250

vestors, the encouragement of national manufactures, etc.

The Demand for Colors

. A greater activity was noted in the sales of dyestuffs, not only to the wool-dyeing concerns but also to the cotton and silk dye works, some of which received very satisfactory orders, in part from the home consumers and merchants and in part for exportation. Among the colors demanded were the acid colors, the basic colors, the indulines, the sulphur blacks, the direct colors such as chrysophenine, diazotizable, direct browns, direct violets, direct greens, etc. As usual, the colors offered from the stocks of war reparation products only satisfied in part the needs of the dyers, allowing a certain business on the part of the home industry, and private importers.

Prices of Coal-Tar Dyes

The quotations of war reparation dyes in Table I, per ton in lire and dollars, show the difference in the dollar and lira prices at the moment of writing, in comparison with the prices prevailing on October 8 (the dyes being delivered in kegs from 25 to 50 kilos).

Through dispositions issued by the Fascisti ministry, the importation of coloring matters and of their intermediates, prohibited by a decree of June 3, 1921, has now been rendered absolutely free by another decree published November 2.

Mordants, Assistants, Dyehouse Products

With such products as caustic soda, carbonate of soda, bichromate of potash, sulphate of soda, silicate

of soda, acetic acid, sulphuric acid, bisulphate of soda, etc., a certain increase in the demand was noted, owing to the activity of the different dyehouses, print works and bleacheries.

Some of the lira and dollar quotations are given, per ton at Milan, in Table II.

Private Dyehouse Quotations

Some private quotations for dyestuffs at Genoa were as follows per kilo, showing how these competed against the war reparation products: Direct Black, 32 to 35 lire; Nigrosine crystals, 26 to 30 lire; Chrome Black in powder, 34.50 to 35.50 lire; Direct Green, 49 to 54 lire; liquid Fustic extract, 7 to 7.50 lire; Logwood extract, 7 to 7.50 lire; Hematine crystals, 8 to 8.50 lire.

BIG YEAR EXPECTED FOR UNITED STATES TEXTILES

American manufacturers are evidently preparing for an exceptionally busy season both in their domestic industries and the export trade. In fact, says the Trade Record of the National City Bank of New York, they are in many cases doubling their importation of raw material as compared with conditions a year ago, while on the export side manufactures are the one group of articles which shows an increase in exportation while other groups show a decline. Manufactures exported in the month of August, the latest month for which we have official figures in this detail, showed an increase of 15 per cent in value when compared with the same month of last year, while the other articles exported showed a reduction of over 33 per cent in value in the same period. The few figures thus far received on September exports indicate that the record of that month will also show a heavy fall in exports of non-manufactured material, and probably an increase in manufactures exported.

All of the textile materials show increases. Cotton, of which we import constantly increasing quantities despite the fact that we produce two-thirds of the world's crop, totaled 7,500,000 pounds in August, 1922, against less than 3,000,000 in August, 1921; wool 34,000,000 pounds against 16,000,000, while raw silk shows a slight increase in quantity despite the fact that the price of August, 1922, imports was $7.14 per pound against only $5.42 per pound in the same month of last year.

Practically all of the other material for use in manufacturing show increases and these include lumber, cabinet woods, pulp wood, wood pulp, paper stock, iron ore, pig iron, lead, zinc, aluminum, asbestos and sulphur ore and, in a considerable proportion of these articles, as in those already enumerated, the quantity imported in August of the current year is double that of the same month of 1921.

FAST FABRICS

Laundry owners are familiar with the efforts that are being made through the various associations to effect a co-operative spirit between the laundry and the textile industries. Not only in the matter of the fabric itself, but also in the matter of the fastness of colors, are laundries deeply interested.

N. Erlanger, Blumgart & Co., of New York, are furnishing a wash fabric, under the trade name of "Everfast," which is sold under a guarantee that these goods are absolutely fast color. The company goes further than this and authorizes the dealer, when selling the Everfast wash fabrics to make "this same guarantee to the customer, refunding the money not only for every yard of Everfast which for any reason does not hold its color, but also the cost of making the garment."

In the announcements of the company it is stated that the Everfast suiting is a mercerized wash fabric. thirty-six inches wide, guaranteed absolutely fast to soap and boiling, fast to sun and weather, fast to perspiration and uric acid, fast to everything it encounters as a dress, blouse or suit fabric, and that "even under the most severe conditions of wear, washing and weather, the original color will last as long as the cloth itself." A color chart is issued showing a number of colors, suc has pink, light blue, pongee, helio, Nile, coral, dark pink, middy, green, black, etc., also containing some samples of this goods (and of some other similar goods) both before and after boiling in washing soda for fifteen minutes. The purchaser is requested to secure a sample of the goods, boil it with washing soda or the strongest laundry soap possible to secure, then expose it to sun or rain for days, and put it to any other test desired. A return of money paid is given for any piece that does not remain absolutely fast in color.

The goods is made in suiting, gingham, Hebrides and Poplin.

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BACK NUMBERS OF DYER & CALICO PRINTER AND TEXTILE COLORIST WANTED

The Lowell Textile School is short of the following issues of the above periodicals: Dyer & Calico Printer —January 1, February 1, March 1, April 1, May 1, June 1, July 1, 1916; also May 1, 1920. Textile Colorist —January, 1920. If any of our readers have copies of these journals which they can spare, please communicate directly with Prof. L. A. Olney, Lowell Textile School, Lowell, Mass.

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